APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

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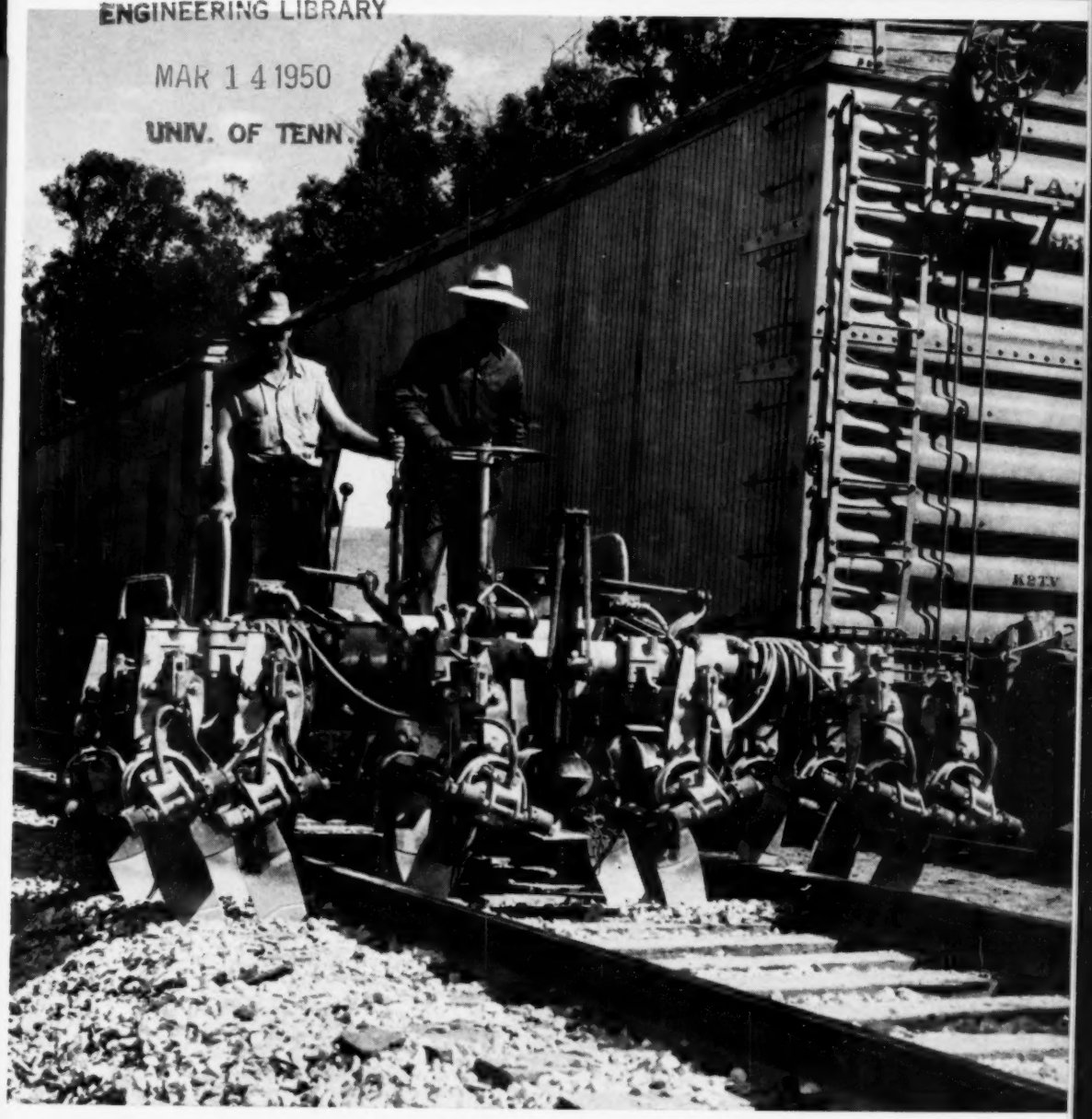

MARCH, 1950

- HYDRAULICS CIRCUITS
- HYDRAULIC CONTROLS
- IR CIRCUITS
- IR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

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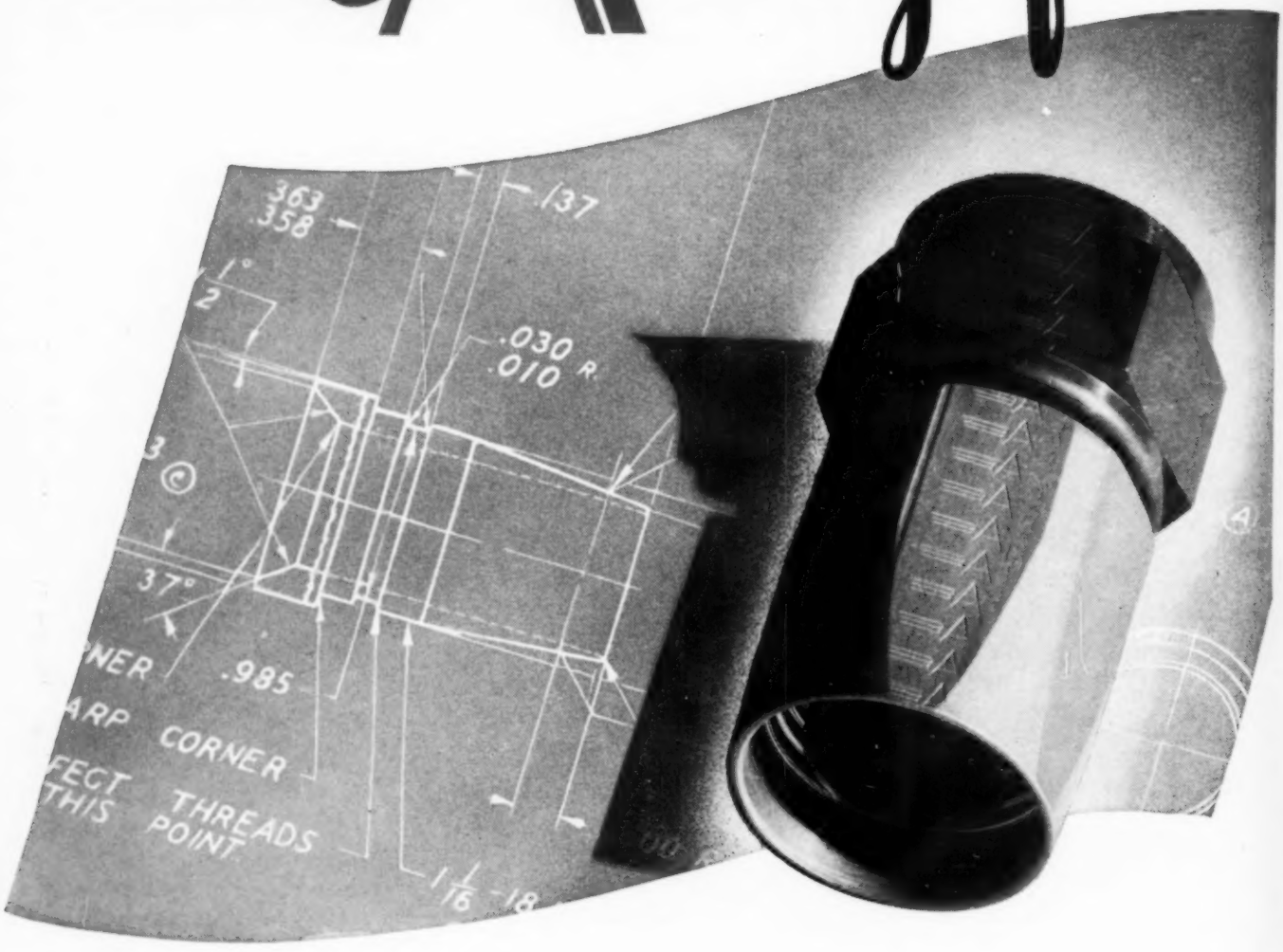
SUPER DC-3 HYDRAULIC SYSTEM, PAGE 26

Always first



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MARCH, 1950
Vol. 3 No. 2

APPLIED HYDRAULICS

The Magazine of Fluid Power Transmission

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FRONT COVER: **A multiple, hydraulic roadbed tamper in operation. The eight heads tamp and level the ballast, cutting labor cost and time cost in track work. The unit shown, is operated by two men; one operates the hydraulic tamping heads, the other the movement of the car.** ***Photo by Authenticated News.***

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NBP ECA

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Like LeTourneau, you will find the Roper F Series a sound investment for installations requiring a pump for pressures up to 300 P.S.I. in sizes from 1 to 300 G.P.M.

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LETTERS to the Editor

Congratulations on the Here's How stuff. Give us more!

J.T.
R.N.

We would very much appreciate your advising us if you know of a manufacturer who can make up or supply a small hydraulic pump which will deliver small quantities of mercury up to 5000 psi pressure. This pump is to be used for filling capillary systems, used in connection with recording thermometers. These systems consist of a holllow metal bulb with capacities from 2 to 25 cc, a capillary tubing and bourdon spring. These systems are filled with mercury under pressures of from 1000 to 5000 psi, after which they are sealed off and welded. The pump would only have to deliver mercury at the rate of a few cc per minute.

F.L.F.

The names of two manufacturers of supplies of pumps for such an application have been sent you.

Can you advise us where we might find a manufacturer of high pressure hose. We are trying to find a high pressure flexible hose that can be successfully applied to our hydraulic pitmans. This hose is subject to pressure at all times and will range from 2000 psi to 8500 psi. Velocity of the oil through a 19/32 in overload valve orifice will in no case exceed 300 fps. We think a ¾ in ID hose will do the job.

W.J.C.

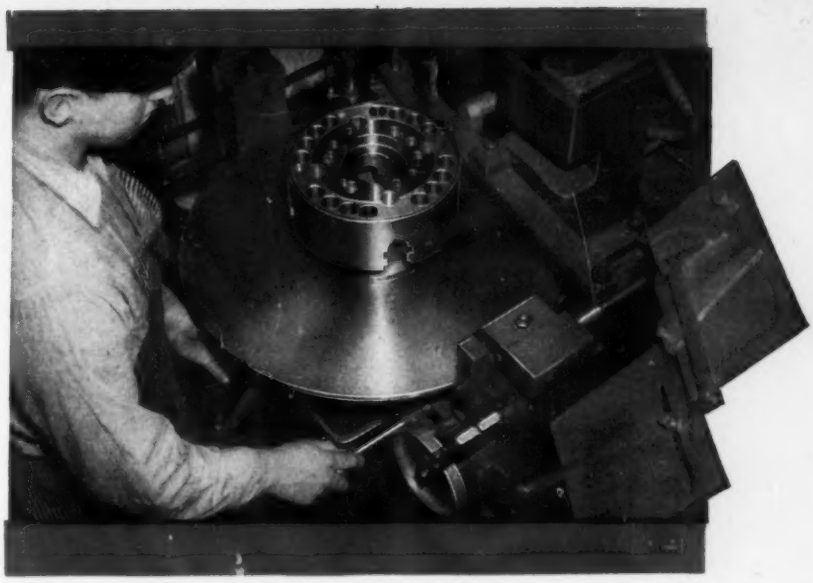
An expert opinion gives us this information: your requirement as to top pressure is approximately half the bursting pressure of commercially available hose. This will result in short hose life since the common rule is to not use operating pressures greater than one-fourth the bursting pressure. If lower pressures cannot be used by redesign, your problem is a tough one. Our consultant suggests you try a triple wire braid hose which is available.

Can you forward the list of publications (books, manuals and data sheets) referred to in the January issue. We are interested in setting up a basic hydraulics training course.

K.M.G.

The supply of this list has been exhausted and we are preparing a new and expanded list made necessary because some items in the first list are obsolete and because several manufacturers asked that specific technical data be added. The next, larger list will be ready in a few weeks and a copy has been earmarked for you.

Important NEW COST CUTTING METHODS and EQUIPMENT will be demonstrated at the CUSHMAN EXHIBIT, BOOTH 866
ASTE INDUSTRIAL EXPOSITION
PHILADELPHIA
April 10-14, 1950



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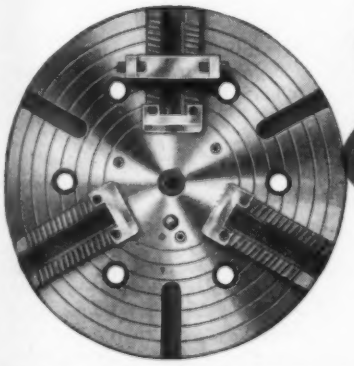
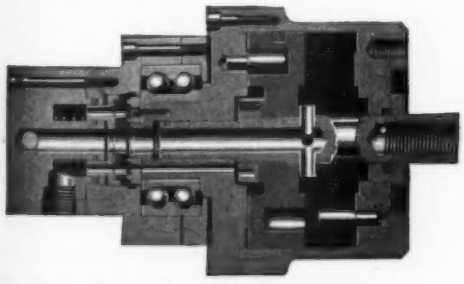


CUSHMAN "ACCRALOCK"* POWER CHUCK



CUSHMAN ROTATING AIR CYLINDER

CUSHMAN WRENCH OPERATED CHUCK

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Today, with the increasingly high speeds at which precision machine tools are operating, it is essential that vibration and chatter be eliminated from work holding and control equipment.

With Cushman Power and Wrench Operated Chucks... and with Rotating Air Cylinders, you are assured of a new degree of smoothness in operation. This is due to our accurate Balancing Checks throughout manufacture and after assembly of chuck bodies and cylinders. No product is shipped without a final static balance test... using the Gisholt Static Balancing Machine illustrated above. We believe this feature to be of great value to buyers of Cushman equipment to be used either for manual or power chucking.

Bulletins covering Cushman "Accralock"* Power Chucks, Wrench Operated Chucks, Power Wrenches and Rotating Air Cylinders, on request.

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- GRC precision "O" rings, two sealing and aligning the rotating unit and two acting as sealing, aligning and vibrating-dampening mountings for the stationary sealing insert, play a very important role in this high-pressure Type P.S. DURA SEAL*.

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AND FOR Your PRODUCT—

- Whether radically new in design and application, or conforming to established practice, your product will be a *better* one by incorporating the quality, accuracy and security of GRC "O" ring seals.
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Mr. O'Ring (pronunciation?—sure and he's Irish!) has your free copy of "O" ring Catalog "C". Just tell him where to send it.

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In the article "Selection and Application of High Pressure Pumps and Fluid Motors" by Herb Vickery, reference was made to a dual vane pump and motor. Who manufactures these units?

J.C.

The name and address of the manufacturer has been forward to you.

We note that a reader inquired in your "Letters to the Editor" department of your January issue about a float valve to control the water level of a tank. We have a similar application for which we feel a pressure switch of the type recommended could be used.
We wish to install a signalling device, probably a light, to warn an operator when the oil level in the reservoir of a lubricator pump is below the refill level. The oil reservoir will hold approximately six pints. Could you recommend the manufacturer of this type of pressure switch?

A.S.

Yes, we can. The valve and the company that makes it has been identified to you by letter.

J.I.C. Hydraulic Standards for Industrial Equipment as published by the Production Engineering Section of General Motors Corporation are available in single copies. Where large quantities are required, it is suggested that they be reprinted in accordance with the paragraph referring to Standards reproduction noted in the J.I.C. Manual. Separate copies of the J.I.C. Hydraulic Standards will be distributed as noted for a short time only, after which they will be incorporated in the General Motors Standards book, "Equipment and Operations".

ASLE Annual Meeting

The fifth Annual Convention of the American Society of Lubrication Engineers will be held at Hotel Statler, Detroit, April 10, 11 and 12, simultaneously with the third annual Lubrication Exhibit. Keynote of the convention will be "Preventive Maintenance Through Proper Lubrication", pursuing the theme which attracted the largest conference on lubrication in history (national lubrication panel at the Plant Maintenance Show, reported elsewhere in this issue).

Among the 21 speakers who will address the ten sessions of the convention are Dr. W. E. Campbell of the Bell Telephone Laboratories, whose subject will be "Lubrication of Electrical Contacts" and Dr. E. M. Kipp of the Aluminum Company of America, who will discuss "Multi-Purpose Lubricants."

Technical Program Announced for Cost-Cutting Exposition

THE TECHNICAL PROGRAM FOR THE American Society of Tool Engineers' Industrial Cost-Cutting Exposition, to be held in the Exposition Buildings, Philadelphia the week of April 10th to 14th, has been announced. A total of 21 papers in addition to the Economics Forum have been scheduled.

Sessions will be held Monday afternoon, Tuesday and Wednesday morning, afternoon and evening, Thursday and Friday morning and afternoon. The program has been distributed so that visiting executives and engineers will have the maximum time possible to visit exhibits.

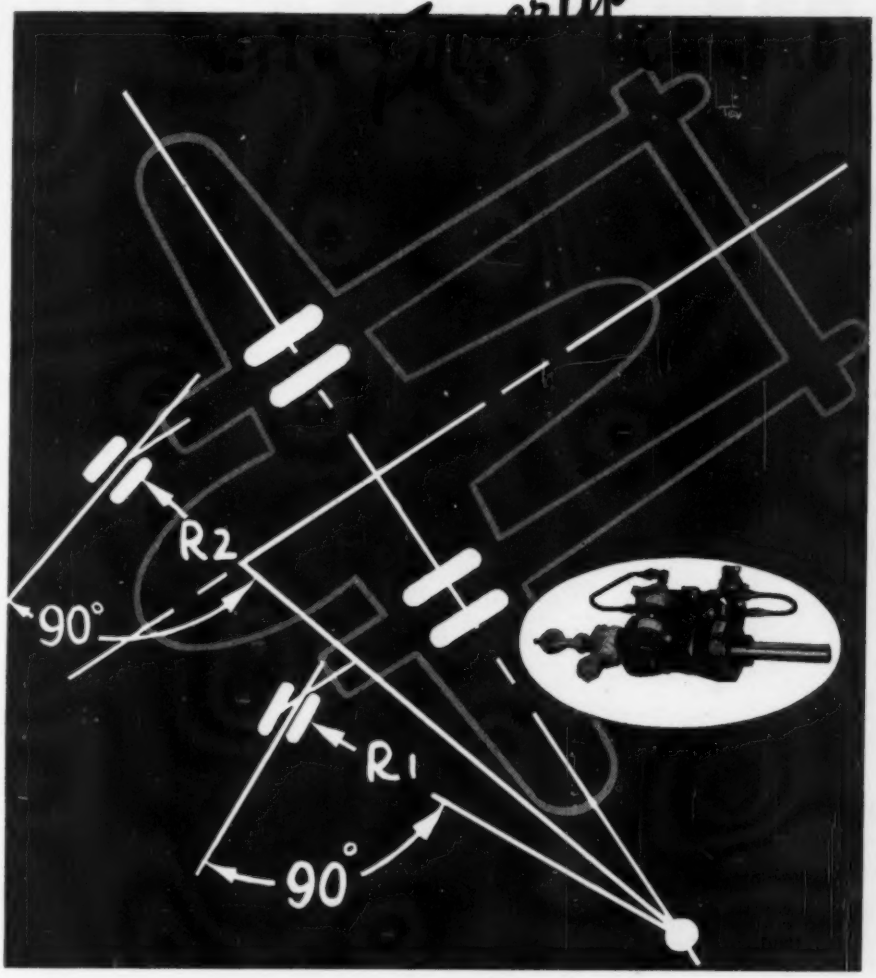
The number of exhibitors has passed 275 and the Cost-Cutting Exposition will undoubtedly be the largest ever held by the ASTE.

Among the outstanding papers to be delivered by nationally known specialists are: "Cold Extrusion of Metals" by Major Weber deVore, manager Ordnance Dept., Heintz Mfg. Co.; "Broaching Applications for Cost Reduction" by O. W. Bonnafe, chief research engineer, The LaPointe Machine Tool Co.; "Cold Roll Forming of Metals" by E. J. Vanderploeg, development engineer, The Yoder Co.; and "How Much Do Materials Cost?" by John Van-Hamersveld, supervisor, Design Cost Control Group, Glen L. Martin Co.

The appearance of the word "automation" in the titles of four of the papers is of interest. This word has been coined to describe the process of converting manual to automatic operation with the twin objectives of reducing cost and reducing the amount of physical labor required from the worker. These papers are: "Automation in Turning and Grinding" by Nevin L. Bean, production engineering department, Mount Road Plant, Ford Motor Company; "Automation in the Forge Shop" by H. K. Howell, plant manager, General Manufacturing Div., Ford Motor Co.; "Automation in the Press Room" by Herman Zorn, president, V & O Press Co.; and "Automation in Hopper Feeds for Assemblies" by C. E. Kraus, president, Kraus Design, Inc.

As is their practice, the ASTE has arranged a number of plant visits during the week.

STEERING TONS



. . . solved by Air Associates for the quadricycle 25-ton Fairchild Pack-Plane. Air Associates met the problem of steering the widely separated nose wheels, by producing the differential steer system illustrated above. In engineering this unique mechanism, we developed an ingenious hydraulic follow-up circuit to govern the movement of the nose wheels *differentially!* This system incorporates compensating thermolators and lock valves to assure constant shimmy damping in case of hydraulic line fractures.

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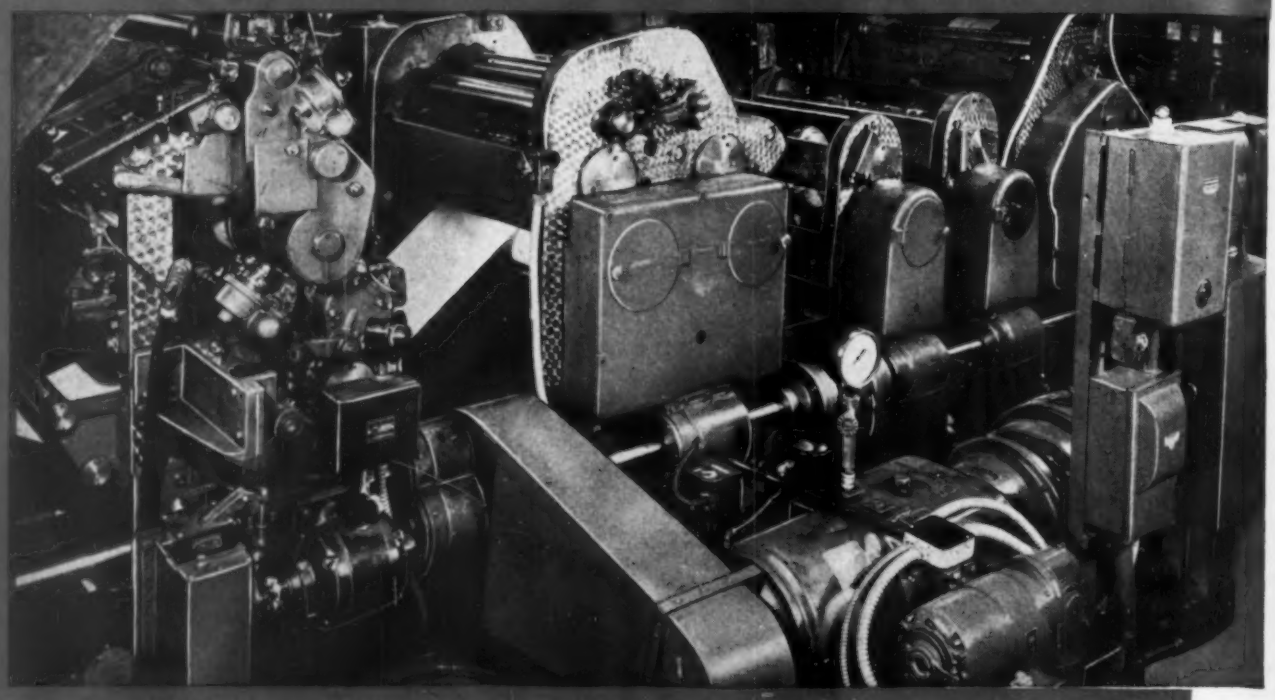

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Hydraulic operation reduces block making cost

An automatically operated, hydraulic powered block making machine, in replacing two previous machines, increased production, saved labor effort and time and cut unit cost over 20 percent.

WHEN MC CRAY & DANIELS Coal Co., operators of a concrete and cinder block making plant at Mentor, Ohio, determined it was desirable to increase their production capacity, they decided, after careful consideration, to replace their two old machines with hydraulically operated, automatic equipment. With a limited labor force, it was important that the time saved by more efficient production be utilized for other jobs in the plant. Since the new machine, a "Multico 8", was adjusted and the molds broken in, the daily average production has been greater than that of the two previous machines, the number of rejects have been negligible, work space has been increased and the takeoff and loading problem has been made much easier. Both time and actual effort spent by the operators has been much less, leaving them comparatively fresh for other duties.

This company is producing both concrete and cinder blocks in three sizes—4, 8 and 12-in standard blocks. The new machine will make at one time, one 12-in and one 4-in block, two 8-in blocks or four 4-in blocks per cycle, the average cycle being approximately 18 seconds. At the rate of close to four cycles per minute, approximately 400 to 450 blocks per hour are being produced consistently.

The new hydraulic block machine contains four hydraulic cylinders, each operated by a double acting solenoid valve. Two cylinders operate upper and lower pressrams, one moves the strike-off hopper to the top of the mold box, the other automatically feeds the pallets and unloads the machine by ejecting the finished blocks. A fifth cylinder, the off-bearer or unloader, functions as a hoist in moving pallet loads from the unloading rack to special pallet trucks.

Aggregate is supplied the machine from an overhead mixing bin through a screw feed, at the top of the machine. One man operates the mixing bin, a second loads pallets on the pallet tray at the rear of the machine, and trucks the finished block to curing rooms and the third man operates the off-bearer. Five men were required to operate the two older machines.

Operation is fully automatic. When the operator pushes the start button, the motor starts the pump

Fig. 1. A front view of the block making machine in operation, showing the loaded off-bearer, the vertical row of time switches, control panel and solenoid valves on the right.

NO RUST SLUDGE

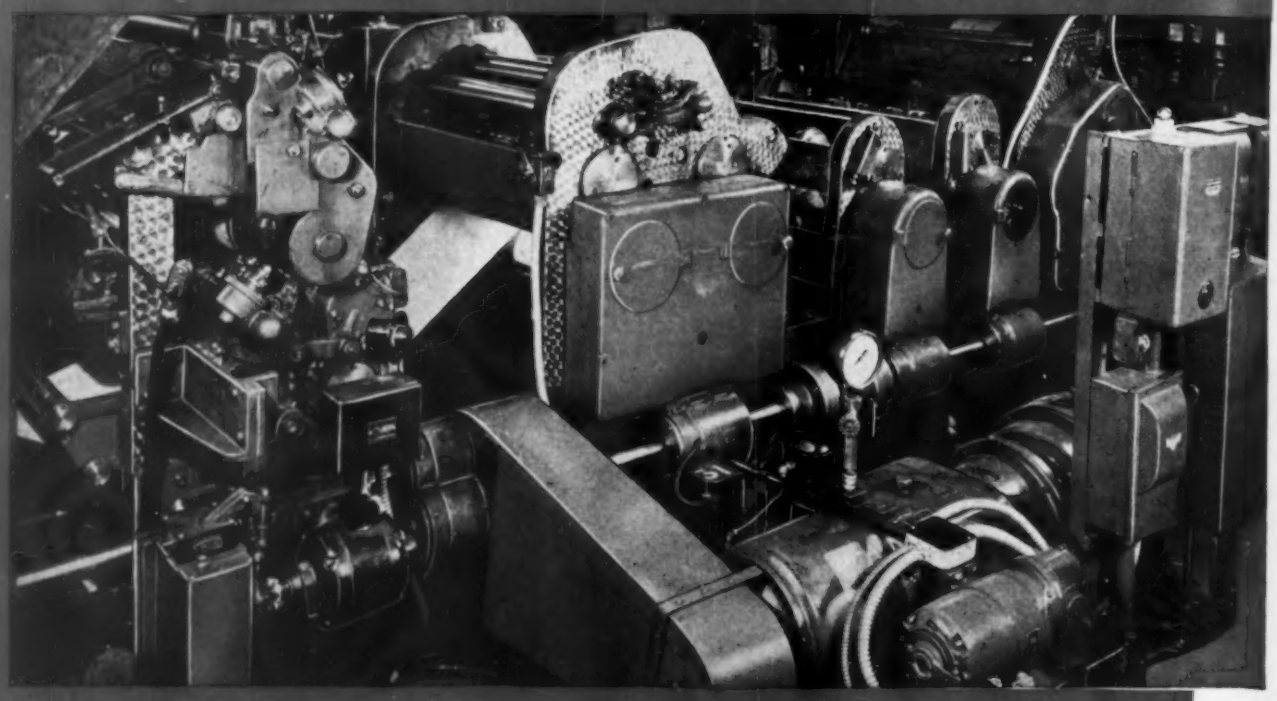

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Fig. 1. A front view of the block making machine in operation, showing the loaded off-bearer, the vertical row of time switches, control panel and solenoid valves on the right.

and, providing there is a sufficient supply of aggregate in the feed hopper, the cycle is automatic and continuous. The strike-off hopper proceeds to the top of the mold box, depositing aggregate; pallets are fed; agitator and vibration simultaneously pack material into the mold; the mold is closed by successive movements of lower and upper cylinder-operated rams; the mold dwells briefly under full pressure; the lower ram retracts, then the upper, after which the pallet feeder ejection cylinder moves the finished block on their pallet out of the press area onto the unloading rails.

Except for the agitator and vibrator, the "Multico" is fully hydraulically powered. The agitator is powered by a 1 hp gear-in-head motor and the vibrator by a 3 hp motor. The agitator motor drives a jogging mechanism which shakes down the aggregate evenly into the mold. The vibration cycle is approximately six seconds for concrete block and approximately 9 seconds for cinder block. Four rubber vibrating units are arranged around the mold box platen in such a way that the loose aggregate particles are moved from the front and the rear of the mold box toward the center of the mold.

The vibrator is rubber-mounted so that the mold box alone vibrates. When the vibration time, set by the timer, has elapsed, the mold closes. The lower ram raises the plain pallet up to the base of the mold block, then the press head colony attached to the upper ram, descends to close and apply pressure on the mold cavity. Approximately 800 psi pressure is applied.

The amount of travel of the upper ram is limited by the joining of the tie bars on the outside of the mold cavity, which acts to size the height of the block. When tie bars on the upper press platen touch similar tie bars on the lower platen, the contact closes a timing circuit and actuates a solenoid to reverse the ram action.

The bottom ram retracts, then the upper ram retracts and another time limit switch energizes a solenoid to actuate the ejection cylinder which moves the pallet with its finished parts out from the mold cavity.

The machine will operate as long as there is a pallet on the pallet loading position. When the last pallet has been pushed forward from this position, a limit switch under the loading position trips, stopping the entire machine operation.

A variable volume hydraulic pump producing a maximum pressure of 1000 psi, is driven through a flexible coupling by a 10 hp totally enclosed, fan-cooled motor. Although a total of five hydraulic cylinders are operated, the sequence of operations calls for not more than two cylinders to operate simultaneously. Individual electric starters are provided for each solenoid.

A jib type crane, anchored centrally on the top extension of the front frame of machine, utilizes a hydraulic cylinder, which is supplied by flexible hoses, as a hoist in the off-

(Continued on page 38)

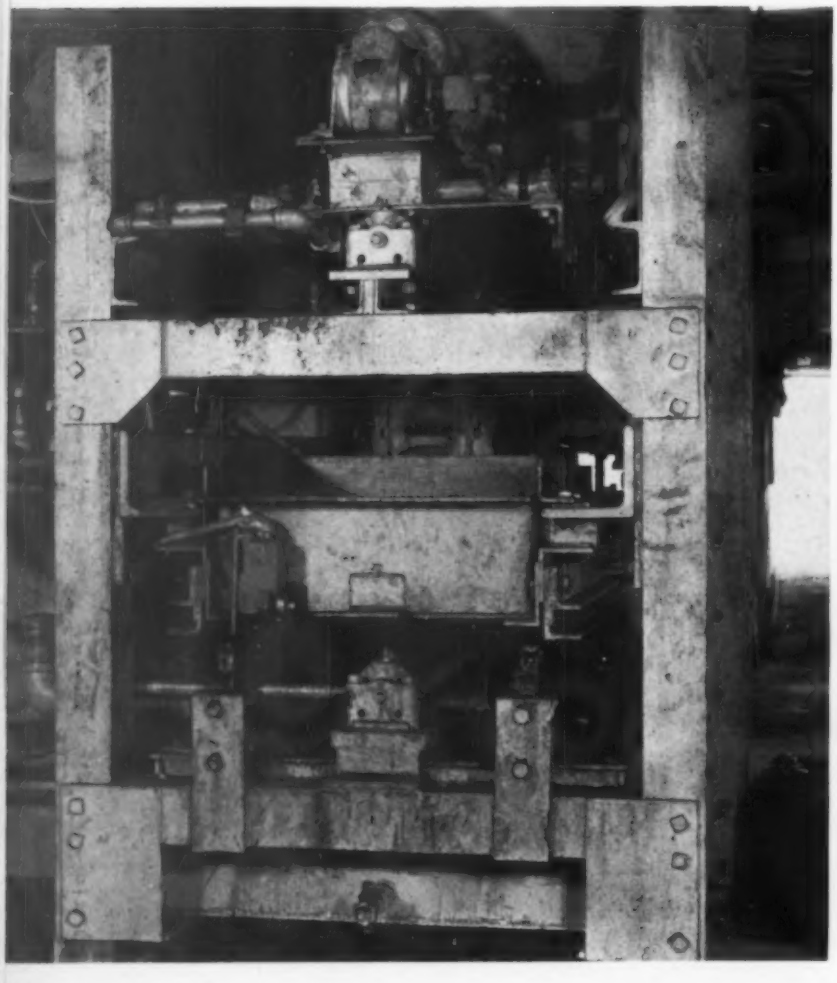


Fig. 2. The open mold box with the front panel removed to show the suspended mold inserts and the vibrator bars which distribute and level the aggregate. The separate vibrator switch for auxiliary vibration and the start and stop buttons are at the right.

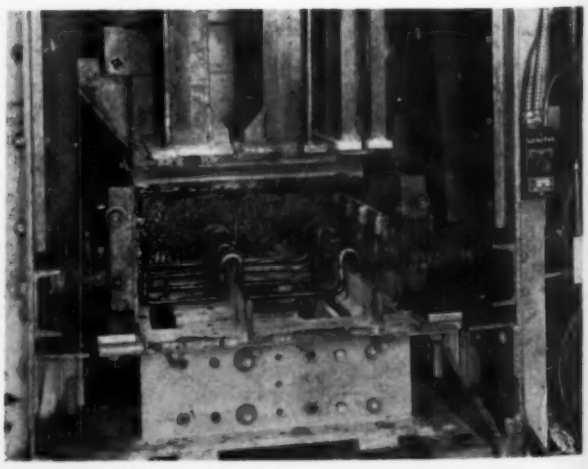


Fig. 3. The rear of the machine showing, top to bottom, the agitator frame and its geared motor drive, the strike-off hopper cylinder, the pallet loading station with its safety switch and the ejector cylinder. The oil reservoir is in the base of the machine frame.

AIR CIRCUIT FOR CLUTCH CONTROL

By W. J. SCHUPNER
Design Engineer
Chicago, Illinois

THERE ARE SEVERAL APPROACHES to this type of circuit design which requires three positive control positions—forward, neutral and reverse. Many of these designs involve custom-built equipment often accompanied by a high price tag.

The circuit described here is versatile, as well as economical, and contains some interesting features. It may be operated either by air pressure or by vacuum from the intake manifold of a combustion engine—a factor which makes it attractive from the standpoint of marine applications. All of the operating units in the circuit can be purchased from one or more cylinder and valve manufacturers. The air cylinders are located on one side only of the clutch lever (in some designs they are opposite), with the resulting advantage that they may be installed some distance away by the use of proper rod extension where proximity of surrounding equipment would be detrimental. Although the control valve is shown to be manually operated, solenoid valves with pushbutton stations may be employed where electrical control is considered desirable.

A sketch of the manually controlled valve is shown in Figure 1. Two four-way manifold type valves are mounted in tandem on a single base with the stems facing each other. A yoke is attached to the stems but is free to rotate about them. The valve lever is pinned to the yoke through a clevis which engages flats on the valve stems. A plate with guide slots, is placed over the entire unit so that the hand lever can be moved only in the direction governed by the slots, somewhat

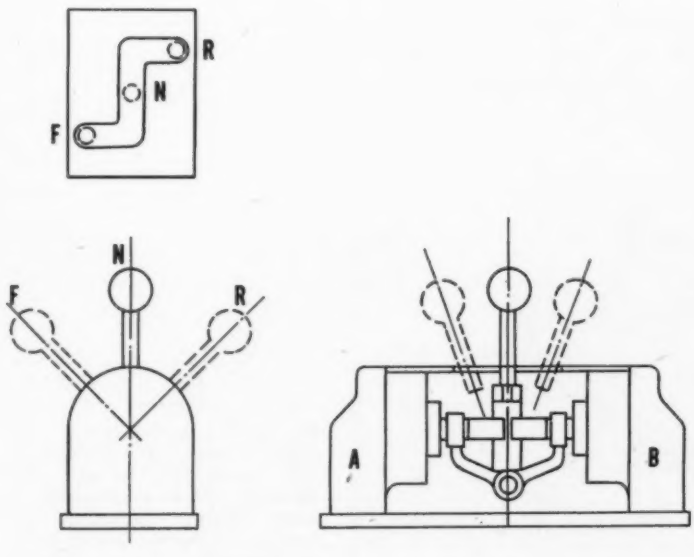


Fig. 1. Two four-way manifold type valves, mounted in tandem with stems facing, utilize a lever pinned to a yoke through a clevis to engage flats on the valve stems. Movement of the lever is restricted by slots in a cover plate.

similar to the gear shift of a car. The forward half of the gear movement, for example, from forward to neutral and return, operates valve "A", while the reverse part of the quadrant action operates valve "B".

Two air cylinders are required, the first operating with double action and the second with single action for pressure operation. Figure 2 shows the piston positions when the valve handle is moved to forward. Air pressure stands on the right hand side of both pistons — the clutch lever having been moved up by cylinder No. 1 through valve "A".

When the valve lever stands at neutral, the clutch lever will stop at the intermediate position indicated in Figure 3 by the reversing of valve "A" which directs air to the left hand side of piston rod No. 1. This rod comes to a stop when it contacts the rod of cylinder No. 2, the diameter of which is larger than cylinder No. 1. Since air is standing on the right side of cylinder No. 2, a positive stop is assured.

Reversing the valve handle will cause both pistons to move to the right as in Figure 4. Note that valve "B", although a four-way valve, has one cylinder port plugged to make it a three-way valve. This was done to save air since piston rod No. 1 in pulling the clutch handle to reverse also pushes piston rod No. 2 at the same time, air in cylinder No. 2 being exhausted through valve "B". In going from reverse to neutral, the larger diameter piston No. 2 will force the air ahead of piston No. 1 back into the line until the static condition is reached, as shown in Figure 3. The area differential between the two cylinders depends upon the power required to operate the clutch lever and to overcome packing friction.

For vacuum operation the exhaust ports of both valves "A" and "B" are connected to a vacuum tank and the former inlet line is opened to atmosphere. Valve "B" must be used as a four-way valve and an additional connection is made to cylinder No. 2, as indicated by the dotted line of Figure 4. Since the pressure available for this type of operation is atmospheric, the slight advantage gained by this change in reducing friction drag during the idle movement of cylinder No. 2 is evident.

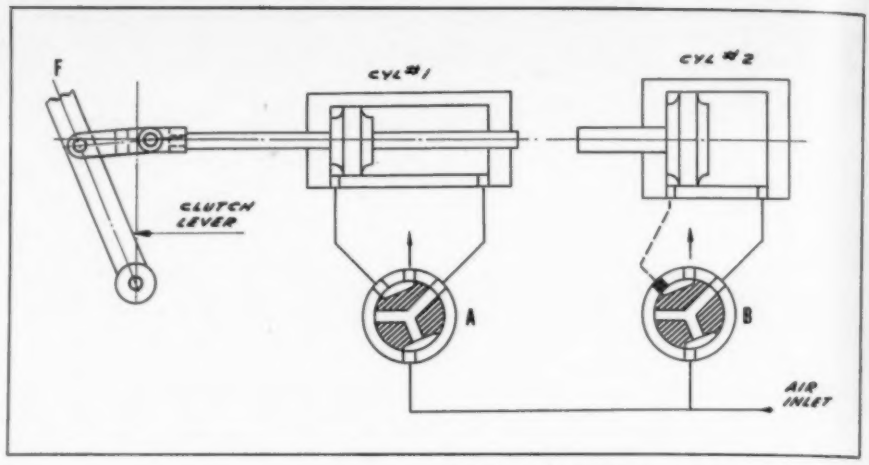


Fig. 2. Schematic arrangement of pistons and valves when valve handle is moved forward. The clutch lever has moved cylinder No. 1 piston to the rear; air pressure enters forward end (right) of both cylinders.

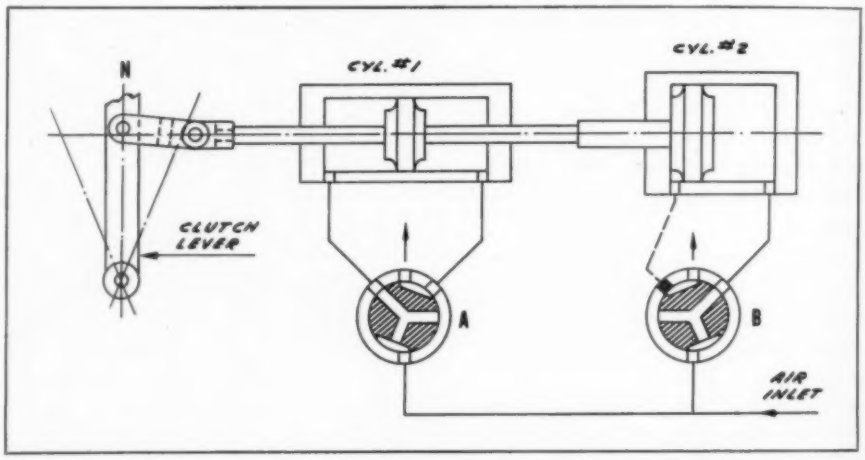


Fig. 3. The valve lever, moved to neutral, moves cylinder 1 piston to an intermediate position, reversing valve "A", directing air to the left side of the piston. In this position the right hand rod comes into contact with the rod of piston 2, assuring a positive stop.

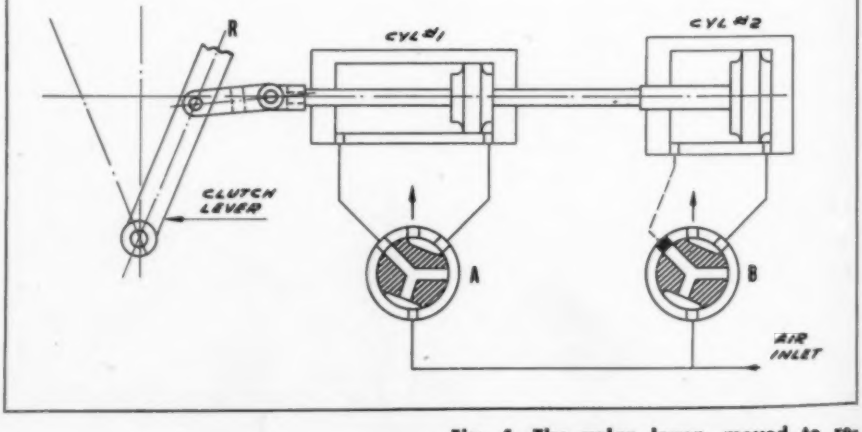
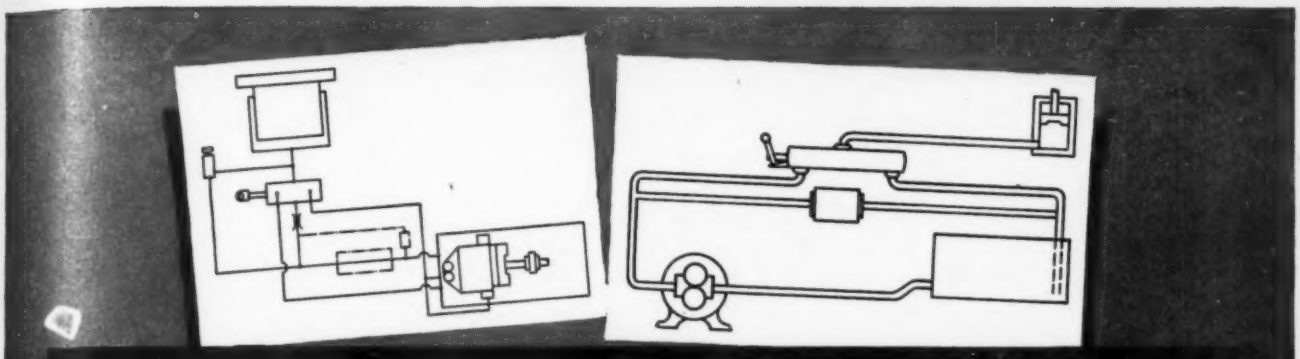


Fig. 4. The valve lever, moved to reverse, moves both pistons to the right. One cylinder port in valve "B" is plugged to save air. In moving the valve lever from reverse to neutral, the larger diameter piston No. 2 will force air ahead of piston No. 1 back into the line, till the static condition of Fig. 3 is reached.



A Beginner's Course in Basic Hydraulics

Chapter V

SIMPLE VALVES

Ball Check Valves; Installation and Maintenance of Valves

Part 2

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Check Valves. The check valve is used to permit flow in one direction and, by closing upon the presence of any pressure from the opposite direction, to prevent flow in the opposite direction. Figure 69 illustrates the ordinary swing type of check valve. It is opened and closed by differences of pressure on its two sides. Closure is sometimes assisted by gravity or by a combination of a spring and gravity.

Check valves should be installed so that gravity assists closure. Check valves are not manually operated.

Liquid flowing in the direction to unseat the swinging disc (right, Figure 69) does so and flows around the disc. When the flow is stopped, the swinging disc will drop, closing the passage. Check valves are made with various types of closing devices. In addition to the swinging disc illustrated, there are the eccentric swinging disc, vertical flow check, horizontal flow requiring the flow to change direction, spring seating disc or ball, as shown in Figure 70, and the self seating ball.

The disc in many check valves is left free to rotate in place so as to distribute wear around its circumference. Swing type check valves offer less resistance to flow than lift types; however, the lift type will close more tightly on low-pressure lines, especially if a spring is added. Conversely, it will open less easily. Lift valves are less likely to slam shut than swing valves. As pressure and velocity increase, however, lift valves are more liable to chatter and pound—a fault to which all kinds of check valves are liable.

Relief valves, safety valves and automatic air vent valves are all really check valves used for special purposes. Their normal working position is closed, and they open only under special conditions.

Relief valves. It is often desirable to make certain that system pressure does not rise above a certain level. Relief valves are used for this purpose. Check valves like those shown in Figure 70 could be used to do this if they are equipped with a spring adjusted to compress when the pres-

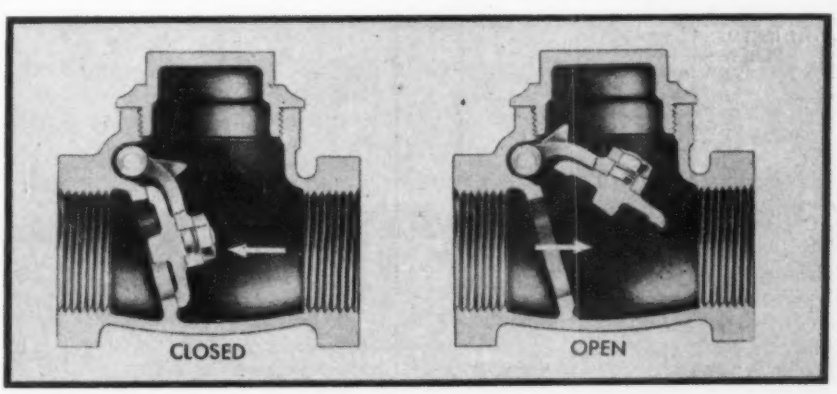


Fig. 69. A cross section through an ordinary swing type check valve.

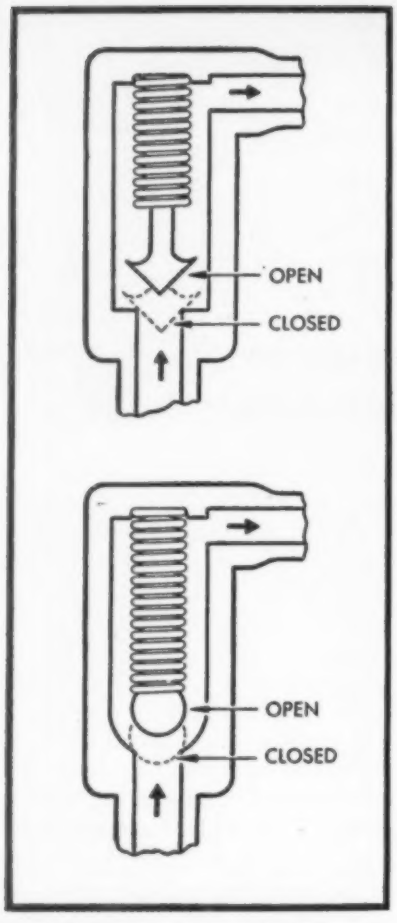


Fig. 70. Piston (top) and ball types of check valves. Note that passages are relatively small and that the valve setting springs are non-adjustable.

sure reaches a definite level. Liquid is then by-passed out of the system or back into a reserve supply. The valve is controlled by means of an adjustment screw against which the top of the spring is seated, as in Figure 71. An inward adjustment of this screw increases the compression of the spring, making it able to resist a higher pressure. Relief valves are usually installed near to the source of pressure, to protect as large a part of the system as possible.

Relief valves can be considered as true safety valves only if they are large enough to handle the entire discharge of the system in the event of a breakdown. Safety valves proper are designed to open only when the system is endangered, e.g., when an operating mechanism stalls. They can take care of the entire load of the system, while relief valves are intended to relieve occasional excess pressures arising during the course of normal operations.

Safety valve. Safety valves are used to prevent pressure rises from causing system damage. Such a valve is placed on the pump or as close as practicable. Normally the valve is adjusted to open at a pressure definitely above normal for the system. This may vary from 5 to 20 percent or more of the normal pressure, depending on the pressure itself, the operating speed of the powered components, the nature of the work done, the balance of the system (rugged or comparatively delicate valves, cylinders, pump and other operating parts), temperature rise and general overall efficiency of the system.

The safety valve, Figure 72, is a typical ball and adjusting spring type with the valve spring setting such that the ball will be forced from its normally closed or seated position only with a definite rise in pressure above the normal circuit operating pressure. Safety valves are designed and chosen so that the valve opening cross section is large enough to handle the entire system flow and to open only when there is a stoppage of the operating mechanism.

Automatic air vent valves. As its name implies, this specialized type of check valve is used to keep the hydraulic fluid free from air. Obviously, the valve is placed in the highest point in the system. The air vent valve, Figure 73, is normally closed due to the system pressure.

As air collects in the valve body, the air displaces the hydraulic fluid. This lowers the pressure, permitting the valve to open and to emit the air. The pressure of the hydraulic fluid behind the air immediately closes the valve. The air vent valve is designed to continuously displace hydraulic fluid by air and to eject the air. Oil is not lost because the pressure again closes the valve. The cycle of operation is automatic.

Installation and Maintenance of Valves

The kind of metal to be used in a valve—brass, iron, steel or special alloys—will depend on the liquid used and the working pressures and temperatures of the system.

Manufacturers of valves specify the range of safe usage for each of their valves and these specifications should be carefully heeded.

Valves should be handled carefully. If a valve is dropped, a part vital to dependable operation may break or become deformed. Valves should not be located where they are

(Continued on page 40)

Fig. 71. A relief valve, ball type with holding spring. The spring is adjustable to take care of a range of operating pressures.

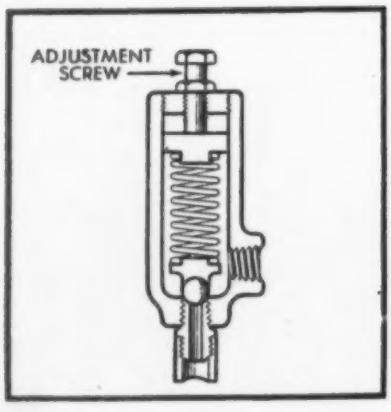


Fig. 72. A typical safety valve with lock nut hold screw for adjusting valve opening to the safe maximum circuit pressure. Note ball and cross sectional passages are larger than in the relief valve and that the valve spring is heavier.

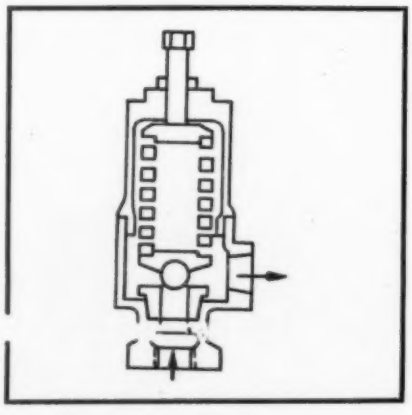
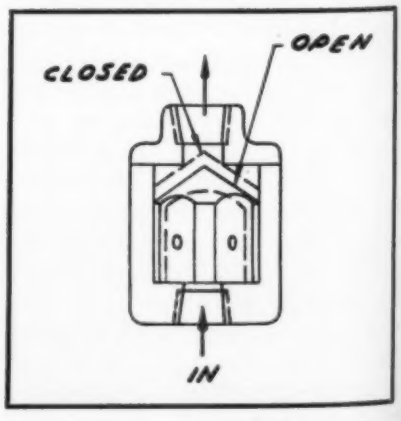
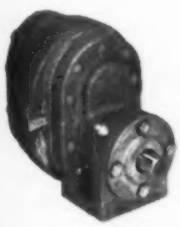


Fig. 73. The automatic air vent valve operates on the principle that air displaces oil at the highest point in the system. The valve opens as pressure decreases, emitting air; oil pressure again closes the valve.

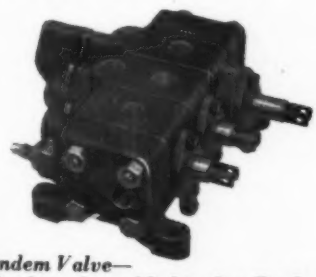


"ALL CLEAR BEHIND"

Traffic will flow—
Parking problems will be normal—
Commerce will hum—as shortly now,
The snow that fell during the still of the night
will be removed, and traffic lanes opened.



Pedestal Mounting Single Type Gear Pump.



3/4" Tandem Valve— Three Sections Assembled in One Bank.

Single Acting Solid Plunger Cylinder.

Double Acting Solid Plunger Cylinder.

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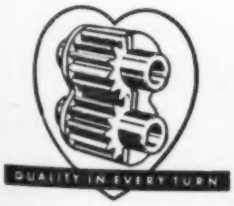

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HERE'S HOW

- PREVENTIVE MAINTENANCE
- SERVICE PROCEDURES
- MODERNIZATION
- SHORT CUTS

Feeds in Two Directions With a one Direction Feed

RECENTLY we installed a new circuit on a boring machine which provided three feeds in one direction and two feeds in the opposite direction. This was accomplished by installing a pilot operated four-way valve, D, in the table cylinder lines, Figure 1. This valve was operated by the solenoid operated four-way pilot valve, which also operates backface stop cylinder. Pilot pressure was provided by installing a 50 psi check valve, I, in the reservoir line.

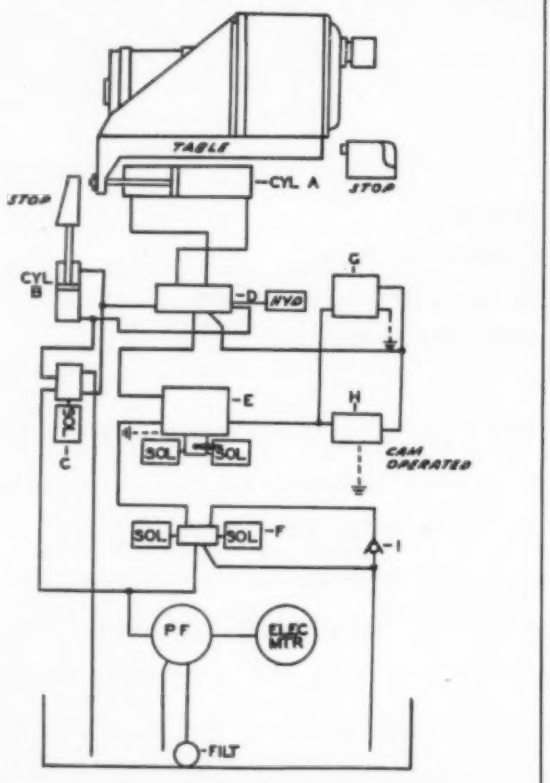


Fig. 1

This arrangement of a solenoid operated panel, E, providing two feeds in one direction, an additional flow control, G, and a cam operated two-way valve, H, together with valve, D, provided the necessary number of feeds. It is felt that this arrangement will eliminate human error and negligence in the proper selection of feeds.

A square bar, with T-slots on three sides, and carrying the necessary stops and cams, can be rotated to select each of the three parts of the cycle. On the end of this bar, Figure 2, are three cams which operate limit switches (LS1, LS2 and LS3) which set up and interlock the electrical controls.

Several additional limit switches are used to operate the

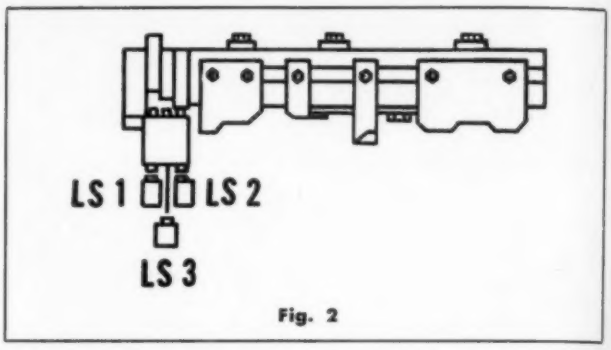


Fig. 2

solenoids of the panel, E, and four-way valve, F, to position the table for tool insertion and removal; and for boring bar approach and withdrawal.

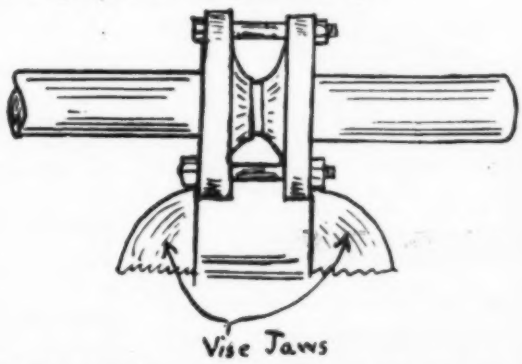
W. T. MCCORMICK
209 North Frink St.,
Peoria 5, Ill.

Repairing a Leaky Joint Under Pressure

A high pressure pipe line developed a leak in a bolted gasket joint in our shop. The line was critical and my orders were to stop the leak without shutting down the line if at all possible.

Examination showed that the lower bolt, shown in the sketch, was too short in the threads to turn the nut on farther. The leak was on the lower side and it was apparent that the bolt would have to be removed and a longer bolt used to stop the leak.

We took a small work bench vise and blocked it up securely under the pipe, the jaws firmly caught on the edges of the flanges. We tighted the vise jaws and relieved the bolt of its stress. This stopped the leak, so we went ahead and removed the bolt and replaced it by another which had a longer thread and tightened it up.



We eased off the vise. There was no evidence of a leak and none developed later.

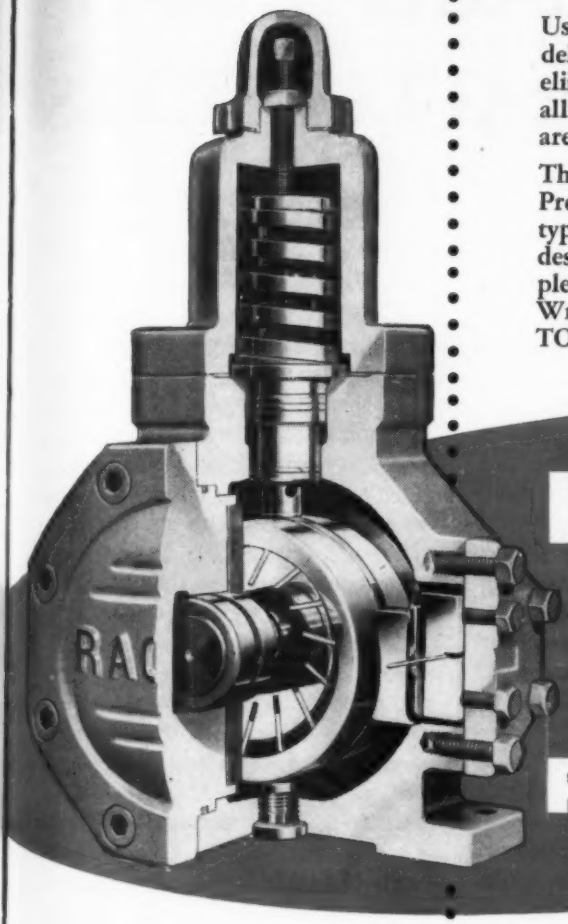
We would not recommend such an expedient as a regular maintenance procedure but it worked in our case and saved us an expensive shutdown.

W. F. SCHAPHORST,
45 Academy St.,
Newark, N. J.

Readers are invited to contribute their short cost and labor saving shop or plant ideas. Each contribution will be acknowledged and considered for publication. We will pay $5.00 for each item published. —Here's How Editor

Put ALL of the Oil to Work

Simplify the Circuit and Improve Its Efficiency



Use RACINE Variable Volume Pumps; they automatically deliver only the exact volume required. Relief valves are eliminated. Heating is reduced, horsepower saved. Overall cost of circuit components is less. These advantages are yours when you "put all of the oil to work".

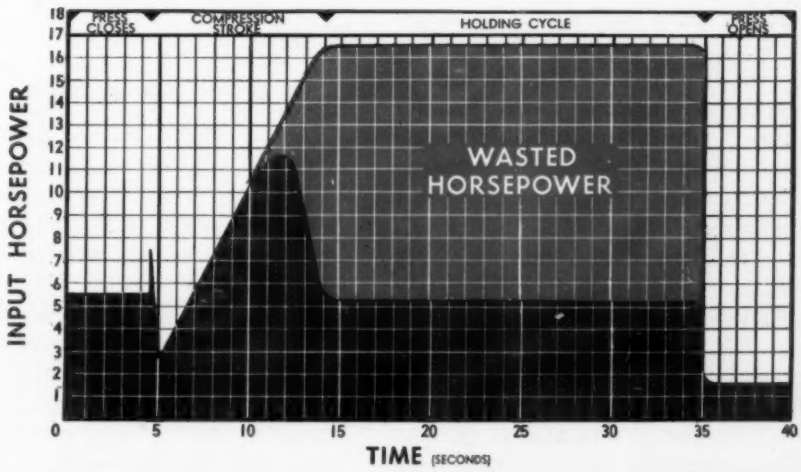
The RACINE Line is complete. Pumps to 30 G.P.M. Pressure Boosters to 5000 P.S.I. Balanced piston sleeve-type 4-way valves, straight-way valves and controls, all designed for manual electric or hydraulic operation. Complete factory and field engineering service without cost. Write for Free, complete 3-color catalog P-10-D. RACINE TOOL & MACHINE CO., 1785 State Street, Racine, Wis.

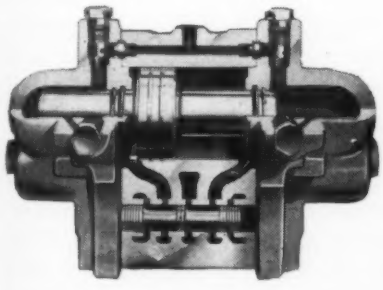
RACINE

Variable Volume

PUMPS

The black area in the chart below shows the H. P. consumed during one complete cycle of operation when a No. 6 RACINE Variable Volume Pump and 7:1 Pressure Booster is used. The red area shows the wasted additional H. P. required when an efficient 2-pressure, 2-volume Constant Volume Pump of equivalent size is used. Note the savings in H. P. Chart is based on the operation of a 200-ton molding press with a 10" ram.





RACINE
Hydraulic BOOSTER

A 7:1 ratio pressure booster was used in the circuit in chart at right. Pump pressure of 725 p.s.i. was increased to 5000 p.s.i. with no increase in H. P. Racine Pressure Boosters are available in 3:1 to 7:1 ratio sizes.

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STANDARD FOR QUALITY AND PRECISION

By R. O. ISENBARGER

Part II

THEORY and PRACTICE in the DESIGN of HYDRAULIC SEALS

Types of Hydraulic Seals

HYDRAULIC SEALS MAY BE UNItary, consisting of a single element, or they may be fabricated from two or more dissimilar parts. In either case many seals may be used singly or in multiple. A seal is radial or axial according as its contact pressure is directed at right angles or parallel to the axis of the sealed member.

Most dynamic seals may be also used as static seals.

The unitary or single-member seals are formed, molded, or cut to the proper shape from leather, rubber, and other materials, and in general, are of two types, the jam or compression packing and the pressure-actuated seal.

The jam packing is so called because it is confined in a gland around the shaft and jammed down axially by a gland nut so that a deformation of the packing causes it to hug the shaft or bore. This type of packing is used on rotating and reciprocating shafts and also on pistons, and is often used for sealing high pressures. They are made in various shapes as shown in Figure 5. Friction is usually rather high although this, of course, depends upon lubrication, speed, pressure, and the materials used.

Pressure-actuated seals are of two classes, those which depend for their sealing upon an actual deformation of the material by the hydraulic pressure, and those in which the sealing is accomplished by means of a deflection of a portion of the seal by the pressure. In the first type, the seal is placed in a groove in such a way that there is enough contact pressure due to direct compressive stress in the material to accomplish sealing at zero or low pressures. When greater hydraulic pressure is applied, the material has a tendency to reshape itself in such a way as to fill the space away from the pressure which increases the contact pressure.

While seals of this type are made in a number of shapes, by far the most popular shape is one with a circular cross-section, the "O" ring. The "O" ring may be used either as a static or dynamic seal for reciprocating motion on piston or shaft. At pressures higher than 1500 psi, it should be used with a back-up washer as shown in Figure 6 to prevent extrusion. "O" rings are not as a rule recommended for rotary applications except at very low pressures and speeds. The "O" ring is quite useful as a static seal, but must not be used where vibration or movement between the members is greater than the permanent set which is bound to occur. The "O" ring should be replaced if the unit is re-assembled since it is difficult to get the "O" ring back in the same position, and due to the set that has taken place, leakage may occur.

Other Unitary Seals

In the other class of pressure-actuated unitary seals, in which the hydraulic pressure causes a deflection of a portion of the seal to accomplish the sealing, one type has its cross-section shaped like a "U" or "V" with the open portion facing the hydraulic pressure so that it deflects the lips against the sealed members. It is installed in grooves similar to the "O" ring grooves. In order that the lip portions are able to move freely, the groove space in the direction of the axis of the cross-section should be somewhat greater than the cross-section in that direction. To take full advantage of this type of seal, the groove in the other direction should be so proportioned that there will be little or no solid compression through the material but only lip flexing (see Figure 7). This provision with the cross-section properly proportioned will decrease the possibility of the lips taking a set since there is a definite stress which must be set up in the material to cause set, and stress created for flexing is much less than the stress set up by direct compression through the same deflection. At pressures over 500 psi, it is advantageous to use a leather or fibrous back-up washer to prevent extrusion of the material into the clearance space. Seals of this nature are recommended for pressures as high as 3000 psi for reciprocating action for use on pistons in cylinders and for shafts. This is an excellent seal for static applications, in particular where some movement or re-assembly is required since it does not have much tendency toward setting and the lips will follow slight side movement.

The cup and flange, two types of pressure-actuated seals, are designed to seal reciprocating pistons in cylinders and reciprocating shafts respectively. These are grouped together because the action of their lips in sealing is similar, the former having the contact pressure outward and the latter inward. Figure 8 illustrates various types of these seals. They are often used in conjunction with spring members to hold the lips against the sealed members. However, in general, springs are necessary only where the side play or clearances are large. In general, the cup and flange will take larger clearances than will other types of seals previously discussed even without spring members.

For proper sealing, it is important that the top edge of the lip be kept in contact with the sealed member. The condition as illustrated in Figure 9A is called a bell-mouth condition and leads to leakage since it causes an unstable lip under the hydraulic fluid movement. This condition can occur either due to improper cup design or improper installation. While some of these seals are made with cylindrical sides, or lips the same dimensions as the cylinder, it is generally considered better practice to make the lip tapered outward or inward as the case may be toward the sealed member so that for the cup the lip edge diameter is somewhat over the cylinder inside diameter and that of the flange is somewhat under the rod size as shown in dashed lines in Figure 9B. This creates an initial stress in the material to cause enough contact for sealing at zero and low pressure. These seals, of course, seal due to the hydraulic pressure forcing the lips against the sealed member at higher pressures. It is necessary that these seals be clamped in place, and the method of clamping is extremely important.

Figure 9A shows the bell-mouth condition encountered when there is too much compression of the bottom portion of these seals due to excessive clamping. Under this condition the material has a tendency to flow toward the sealed member causing the lip to bell-mouth. This is especially true where synthetic material is used.

The clamping should always be limited by metallic contact of the clamping members, and often raised beads are used on rubber cups (see Figure 9C) or ridges are used on clamping members to get the proper clamping without excessive displacement of sealed material, as in Figure 9B. These raised beads or ridges are not always necessary, but limiting of clamping is. Even with these precautionary measures, since the material must be compressed some to hold it in place, some material is displaced. To compensate for this, the seal is made so as to have clearance with the sealed members at its base initially (Figure 9B). Bell-mouthing may also be caused by not having the clamping member extend far enough toward the lip so that the lip portion lifts up as illustrated in Figure 9D. The proper relations of the clamping plate to straight and tapered lips is shown in B and C. Note that at C the plate extends to the inside corners of the seal. It is important that the clamping members be machined smoothly where they contact the seal since this is often the cause of leakage at the clamping portion.

Where leather or naturally porous materials are used, suitable impregnation is necessary to prevent seepage through the material. However, under some conditions a slight controlled seepage is desirable. For low pressures, to make the lip more responsive to the pressures, it is often desirable that the lip edge be sharp beveled as shown in Figure 9E, although where rubber is used some flat, as shown, is desirable to prevent what is called a "toe-stubbing" action, that is, in moving a sharp lip against the surface there is a tendency for the seal to jitter instead of

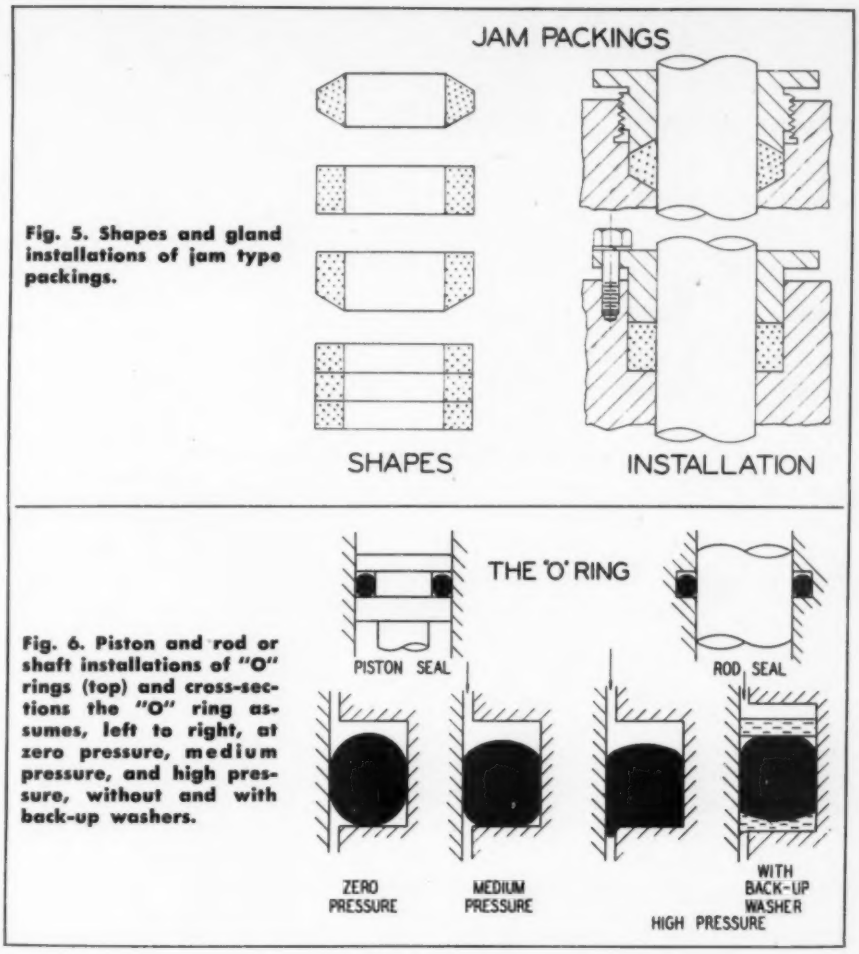

Fig. 5. Shapes and gland installations of jam type packings.

Fig. 6. Piston and rod or shaft installations of "O" rings (top) and cross-sections the "O" ring assumes, left to right, at zero pressure, medium pressure, and high pressure, without and with back-up washers.

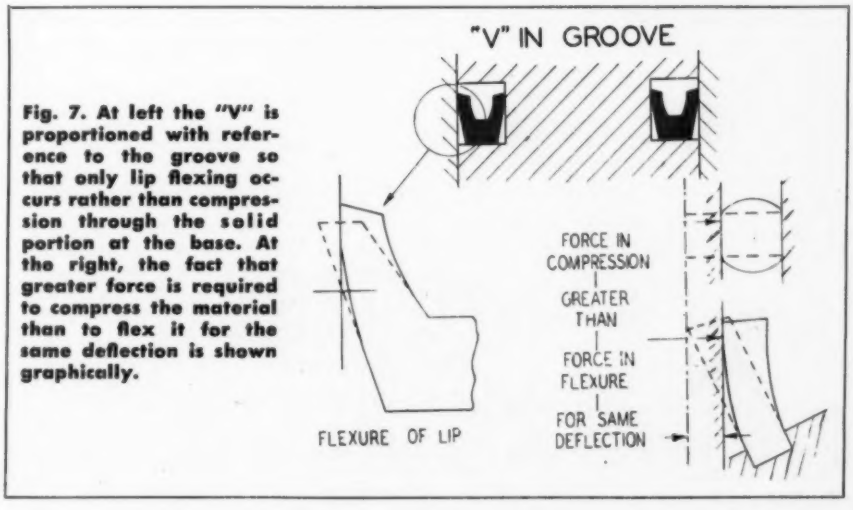

Fig. 7. At left the "V" is proportioned with reference to the groove so that only lip flexing occurs rather than compression through the solid portion at the base. At the right, the fact that greater force is required to compress the material than to flex it for the same deflection is shown graphically.

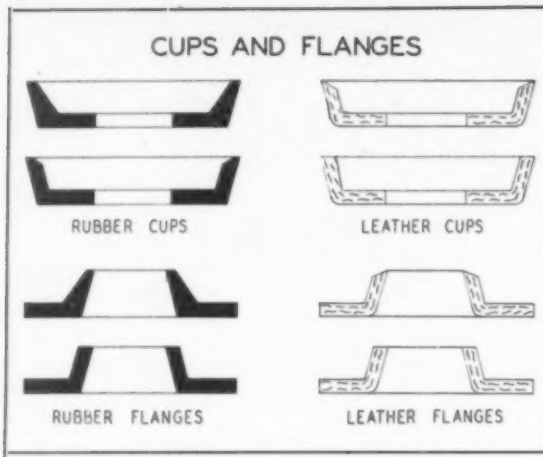

Fig. 8. Various shapes of rubber and leather cups and flanges.

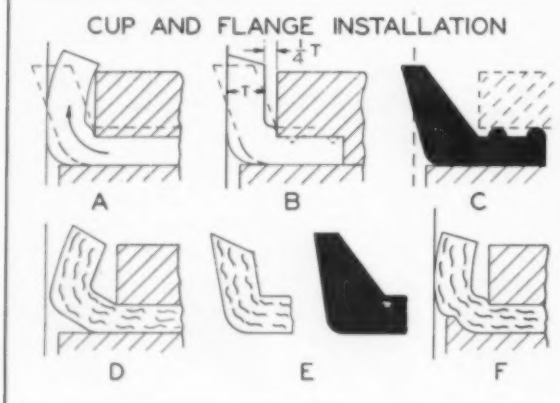

Fig. 9. "A" shows the result of too much compression in clamping; "B", a correct installation with metal - to - metal stop on clamping plate to prevent excessive clamping; ridges as at "B" or cups as at "C" are often employed on clamping plates; "D" shows the effect of too small a clamping plate; "E" illustrates beveled lips in leather and rubber; and "F" shows the effect of incorrect shape of back - up plate.

sliding smoothly. Also, there may be some tendency for a sharp edge to fold under. At higher pressures this beveled edge is not necessary. The back-up plate should never be made as shown in F as this tends to deform the seal and leads to bell-mouthing or extrusion into the clearance space.

It is important to reduce friction as much as possible. The friction is proportional to the area of the contact surface. The lip length of the seal should, therefore, be as low as is consistent with lip flexibility. Where side play is greater, the lip length must be greater to insure contact at all times. The actual proportions are dictated by the specific conditions involved. These seals have been used to cover the full range of pressures ordinarily used. Note that the "U" or "V" seal previously discussed is really a combination of a cup and a flange, the outer lip being similar to the cup lip and the inner similar to the flange lip. The essential difference is that the "U" or "V" is a seal floating in a groove while the cup and flange are clamped in place. What has been said, therefore, concerning the cup and flange, except their clamping, applies also to the "U" or "V".

A type of pressure-actuated unitary seal is the multiple "V" illustrated in Figure 10. This is a seal used for an extreme range in pressures. They may be used for rotation as well as reciprocating motion on pistons and shafts. It is used with end adapters as shown in Figure 10, which may be part of the seal or may be made of metal parts as part of the machine. It is similar to the jam packing in that axial force is applied, but this axial force causes a spreading of the "V" section so as to contact the sealed member.

In installation, the gland nut should be pulled down firmly then backed up just to the point where sealing still maintains. If the gland nut is tightened too tightly, there will be excessive friction and the packing will be damaged. Often as in a jam packing, a spring is used as shown in Figure 10 so that the otherwise frequent take-up will not be required. Although the required spring pressure varies with conditions, the average value is 10 pounds per inch of mean diameter. Theoretically, this packing acts as a multiplicity of sealing lips, the pressure dropping successively across successive lips down to zero across the last lip. Probably, actually the action is not this clear cut and the seal acts partially in this manner and partially as a jam packing. The friction, while usually higher than some of the previously discussed types of seals, is often reduced by alternating a synthetic "V" with a "V" made of some fibrous material which will absorb and hold lubrication. Sometimes for high pressures, a thin metallic "V" is inserted between each of the "Vs". For best proportioning, the stock thickness T (see Figure 10) should be as close as possible to ¼ the cross-section width W.

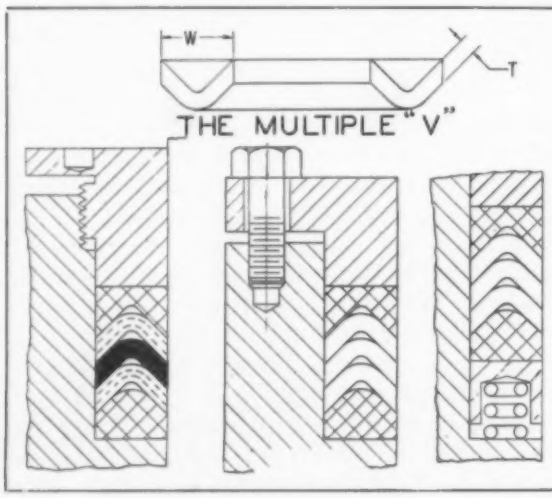

Fig. 10. Typical methods of installation of multiple "V's". Right to left, a screwed gland, a bolted gland and a spring loaded gland. The first shows alternate leather and rubber "V's".

This paper will be concluded in an early issue.

This paper was delivered at the National Conference on Industrial Hydraulics, Chicago, October 26, 1949. This and other paper of the Conference will be published in the Proceedings which will be published by Armour Research Foundation of Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

IT'S NEW!

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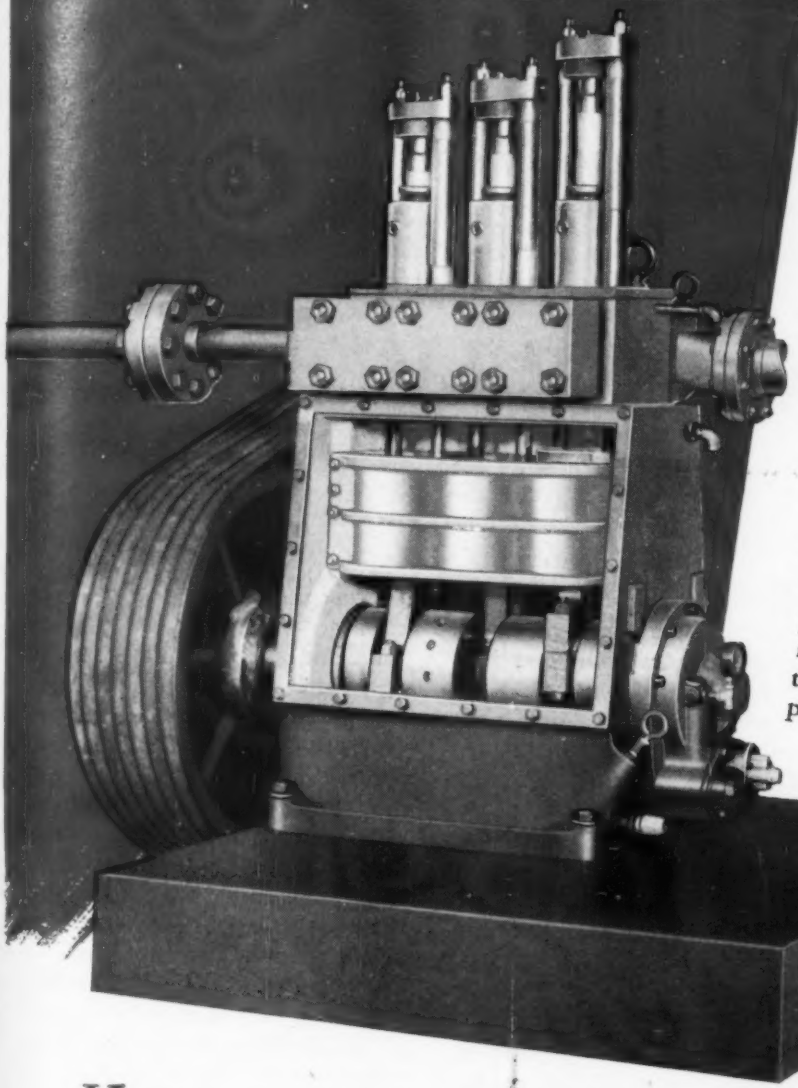

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FRED O. HOSTERMAN
Advisory Editor

SUPER DC-3 HYDRAULIC SYSTEM

THE NEW SUPER DC-3 TWIN-ENgine airliner built by Douglas Aircraft Company, Inc., a modernized version of the well-known airplane which pioneered commercial transport service in 1935, incorporates a number of improvements, including busic advances in the hydraulic and landing gear systems. The net result has been vastly improved performance, larger passenger and cargo capacity and lower indirect operating cost.

Some of the structural changes include shorter wing, completely new outer wing panels and wing tips, redesigned inner wings to improve strength and eliminate service troubles, lengthened fuselage, new landing gear doors and integral loading steps. Other changes include a completely demountable power plant section, relocation of the cargo compartment and other service groups to increase the seating capacity from 30 to 38 passengers in various modifications. The older DC-3 carried 21 passengers.

The hydraulic system pressure has been stepped up to 1100 psi, the system employing two engine-driven pumps instead of one as used in the older system. The increase in pressure permits the use of smaller retract cylinder and provides faster landing gear retraction and improved overall operation.

The pressure supply lines from the pumps, Figure 2, are tied together to insure system operation in the event of one engine failure. A new pressure regulator has been installed to provide for the higher capacity system. The setting of the system pressure relief valve has been increased to 1200 psi.

New Control Valve

A new landing gear directional control valve, designed to reduce the pressure drop in the system to the landing gear, has replaced the older valve which allowed an excessive amount of interflow during handle movement and required very rapid operation to prevent the landing gear from partially lowering during flight. The same type shear-seal, four-way valve has been added in the system to control flow to the wing flap cylinder. Both directional control or selector valves eliminate excessive interflow during handle movements. A check valve is added to the pressure port of the control valve to prevent interflow between the wing flap and landing gear systems.

Landing gear doors have been installed that fully enclose the main landing gear and struts and are mechanically actuated by the gear. The retract cylinders of the main gear are reduced in size, and, because of the additional door loads, the strength of the cylinders is increased. To improve the main landing gear retraction time, additional bungee shock cords have been installed on each gear. New wheels and brakes were installed as a result of the increase in airplane gross weight.

A solenoid-operated latch is installed so that the mechanical latch handle cannot be raised from the "lock" position until the solenoid is actuated. When the right main shock absorber struts are extended to within two inches of the fully extended position, a switch will be actuated which energizes the solenoid and permits the mechanical latch handle to be raised. This permits operation of the landing gear control valve handle. An emergency means of retracting the solenoid latch is also provided.

The tail wheel has been rede-

Fig 1. The Super DC-3, successor to the pioneer two-engine commercial transport liner, is shown with its new integral loading steps lowered. The redesigned hydraulic system of this airplane permits smaller retract cylinders, faster landing gear retraction and improved overall operation.

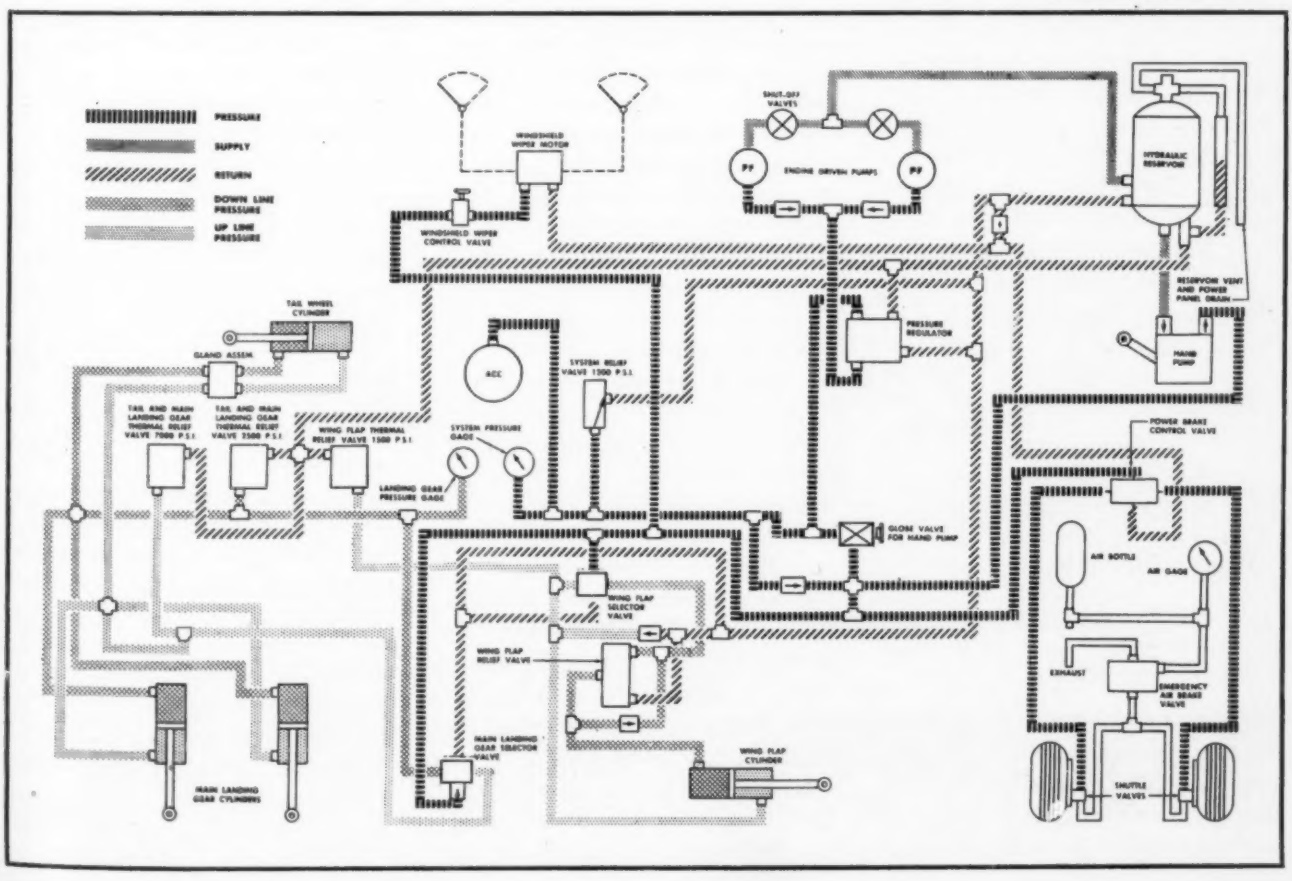
signed so that it is retractable and operates simultaneously with the main landing gear. A bungee spring is installed on the tail wheel so that, in the event of hydraulic failure, it will extend and latch mechanically. Stops are provided to restrict the swivel of the tail wheel during normal operation to approximately 120 degrees on each side of neutral. The wheel mechanism is spring-loaded for automatic centering.

A master change has been made in the hydraulic system fluid. The Super DC-3 is supplied with an ester base, synthetic, non-flammable hydraulic fluid, a development of the Douglas Company and a major chemical manufacturer. This fluid meets most of the important requirements of AMS Specification 3150 and offers exceedingly good pump life. The new synthetic hydraulic fluid has been in service for more than six months with no indications of difficulty. However, the fluid does require special gaskets, packing materials and other components.

Hydraulic fluid firewall shut-off valves are installed aft of each nacelle firewall and are operated from the flight compartment.

The changes in the hydraulic system of the Super DC-3, some representing improvements, others entirely new equipment, have resulted in a system characterized by higher pressures, smaller and faster acting cylinders, improved valving to correct interflow during handle movement, greater safety, with two pumps instead of one and the use of a non-flammable hydraulic fluid, and improved overall system operation.

Fig. 2. Schematic plan of the hydraulic system.



BASIC THEORY AND APPLICATION OF HYDRAULIC SYSTEMS

By JAMES T. CLARK

A HYDRAULIC SYSTEM, IN BRIEF, consists of an oil reservoir, a pump driven by a suitable prime mover, pressure controls to limit system pressures to a safe level for both the pump and the machine parts actuated by oil pressures, and a directional valve for changing direction of oil flow to the fluid motor or hydraulic cylinder. To this elementary system such auxiliary controls as volume control valves and a variety of pressure valves may be added.

Our purpose is to cover questions arising in the everyday application of hydraulic system components.

If one component can be singled out as the most important in the system, our experience indicates that the tank design would lead all others. The important functions of a tank are: (1) it prevents the turbulence of the returning oil from disturbing the oil at the pump suction; (2) it allows dirt, air and water to separate from the oil; and (3) it dissipates heat generated in the system. Necessary tank accessories are an oil level gauge, filter type breather cap and seals to make the tank air tight. Straight ells and hose should not be used on pump suction lines when avoidable, due to the fact that the interior area of these elements are generally less than those found in other standard fittings.

The type and size of the pump are determined by several relatively simple calculations:

$$\text{Cylinder area (sq in)} = \frac{\text{force (lbs)}}{\text{selected pressure (psi)}}$$

$$\text{Pump volume capacity (gpm)} = \frac{\text{cyl area x speed (ipm)}}{231}$$

Either a variable volume pump or a constant delivery pump with a volume control valve can be used for varying rates of speed of the piston or fluid motor. If flow control valves are used, that portion of pump volume not used for mechanical movement will cause heat, and the necessity of an oil cooler should be checked.

Among the variable volume pumps available are those which incorporate a stepless change in their output and those which provide a change in volume by cutting in or out one or more of a group of pumps. In the latter case, pressure controls can be so arranged as to make automatic the change from high volume to low volume. By using this pressure unloading, the size of the electric motor or gasoline engine can be kept to a minimum, due to the fact that the large volume pump is used only during the relatively low pressure or approach portion of the cycle.

As fluid motors are rated according to torque, the following formula will be useful:

$$\text{Torque, in lb} = \frac{\text{hp x 63025}}{\text{Speed, rpm}}$$

After selecting a motor according to the torque requirements, the following will determine the volume of oil needed:

(Continued on page 39)

HYDRAULIC COMMITTEE COMPLETES FIRST YEAR OF WORK

THE COMMITTEE ON HYDRAULIC and Pneumatic Systems, initiated in December, 1948, by Anthony Hunter and Dr. Peter Kyropoulos, directors of the Hydraulics Division of the ASME Southern California Section, has completed its first year of work. Activities included three phases: (1) the preparation of a manual on recommended practices in the selection, design, development and testing of hydraulic and pneumatic systems and their components; (2) a series of consultation meetings or seminars on the basic theory and applications of hydraulic and pneumatic systems and their components; and (3) a similar series on specific applications of hydraulic and pneumatic systems in industry.

Howard Field, Jr., consulting engineer, was appointed chairman and J. S. Newton, research engineer with North American Aviation, Inc., assistant chairman at an organizational meeting in January. In June W. J. Williamson was appointed secretary. In November Mr. Field was forced to resign because of his health and Mr. Newton was elected chairman. Subsequently, H. K. Palmer, consulting engineer, and H. E. Karig, section engineer, Navy Ordnance Test Station, Pasadena, were appointed vice chairmen.

In order to assure proper coverage of subject material, the American Society of Civil Engineers, The Institute of Aeronautical Sciences, The Society of Automotive Engineers and the American Rocket Society were invited to participate. The Committee now is sponsored by all of these societies.

The basic content and organization of the manual were discussed at monthly meetings. Mr. Palmer completed a section on Hydraulic Hammer and several committee members have other material on preparation. The Committee now consists of an advisory board of 11 and 18 members working on specific projects.

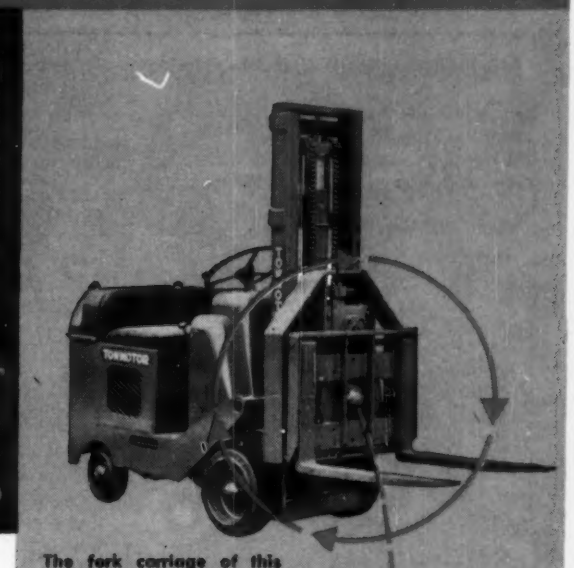
Committee chapters were initiated in New York and Chicago. Anthony J. Zino, assistant sales manager, Swan-Finch Oil Corporation, heads the New York chapter; Howard F. MacMillin, president, MacMillin Engineering Corporation, heads the Chicago chapter. Mr. MacMillin has started the preparation of a section on hydraulic press systems.

The seminars consisted of monthly meetings with prominent engineers leading the discussions. A short report of the first of the meetings is printed elsewhere in this issue. There were six meetings in the first series and the second series began in October. When this series is completed a symposium on Hydraulic and Pneumatic Operating and Control Systems is planned.

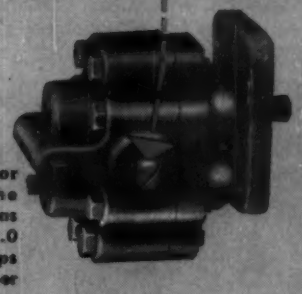
J. S. NEWTON
Chairman

Another Job for Pesco HYDRAULIC MUSCLES

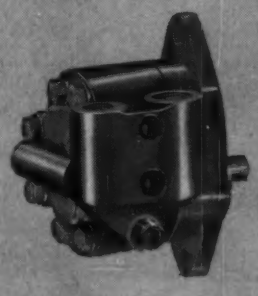
DUMPING MULTI-TON LOADS IN 5 SECONDS



The fork carriage of this Towmotor model revolves 360 degrees in either direction.



The hydraulic motor which revolves the Towmotor carriage has a displacement of 1.0 cu. in. and develops 14.5 in.-lbs. torque per 100 p.s.i.



This Pesco hydraulic pump which develops the power for the above motor has a displacement of .577 cu. in. Capacity: 3.5 g.p.m. at 1500 r.p.m. at 1000 p.s.i.

● One of industry's most effective material handling time-savers is Towmotor's fork lift truck with the revolving carriage. With it a man can quickly and easily transfer heavy loads of solid, liquid, or granular material from one container to another.

The ingenious device that revolves the fork carriage in a 360-degree circle, in either direction, is actuated by a Pesco hydraulic motor so small it will fit snugly into the palm of your hand. Yet it is so powerful it will flip loads up to three tons completely over in five seconds!

Towmotor is one of the rapidly growing number of industrial equipment manufacturers who are turning to Pesco for answers to their hydraulic problems. They have found that the skills and precision craftsmanship that Pesco has developed to meet the exacting requirements of the military and civilian aircraft manufacturers insure the high quality and trouble-free operation they demand in their own products.

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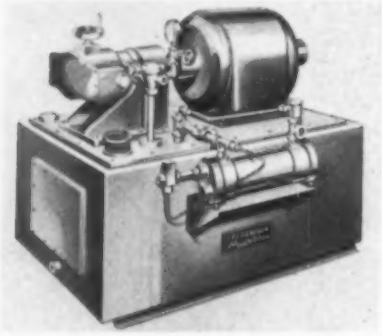
High Pressure Pumping Units

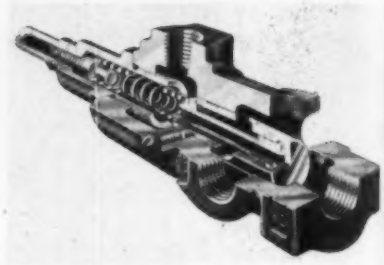
The Denison Engineering Co. has just announced a completely new series of oil hydraulic pumping units for regulative pressures up to 5000 psi. Designed



to meet a wide range of fluid power requirements for machine tools and other industrial equipment, the line includes 22 models, all of which meet specifications recommended by the J.I.C. Hydraulic Standards. Each unit consists of a reservoir base, pump, relief valve, gauges and electric motor drive, mounted on the removable top cover. Three series of Denison axial piston type pumps, rated at 9 to 35 gpm up to 5000 psi are available, with handwheel, pressure compensating, stem or cylinder control of oil delivery. Standard two-pass heat exchangers are optional equipment. *1.*

Differential Relief Valve

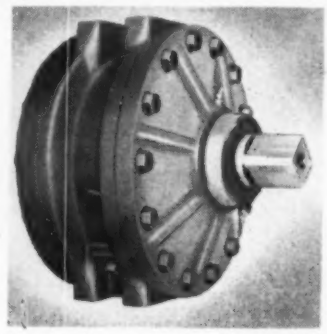
Hydraulic Equipment Company has designed an adjustable, high pressure differential relief valve, the VR series. Inherent design characteristics of the valve have entirely eliminated objectionable valve chatter. An important feature is its differential piston which reduces the effective area of the main poppet valve without reducing actual flow area. These valves have capacities



from 5 to 80 gpm, and are designed to operate from pressures of 400 to 1650 psi. *2.*

Hydraulic Torque Actuator

Hydromotor, Inc. announces its entirely new hydraulic torque actuator said to be the first such successful development to be made available to industry. The first three standard sizes



will be rated at 10,000, 50,000 and 100,000 inch pounds of torque at 1000 psi hydraulic pressure. The units provide

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INTERNAL SNAP TYPE KEEPER RING

AMPLE BRONZE BEARING—ORIENTED BEHIND PACKING TO REDUCE SURGE PRESSURE

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PISTON AND RAM POSITIVELY SECURED BY PATENTED LOCK NUT

"O" RING SEALS

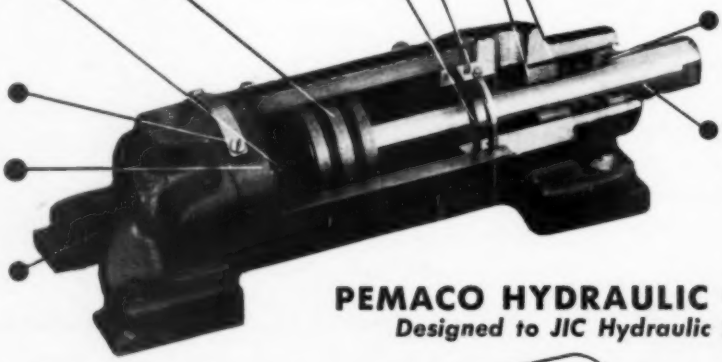
"SEAL GUARD" RAM SCRAPER POSITIVE PACKING PROTECTION

BRONZE COVER PLATE

50 ROCKWELL—HARDENED & GRD. STEEL RAM —SCORE RESISTANT

PRECISION HONED STEEL TUBING

"HEAVY DUTY" HI-TENSILE CAST IRON CASTINGS (STEEL CASTINGS OPTIONAL)



PEMACO HYDRAULIC CYLINDER
Designed to JIC Hydraulic Standards

Precision built with all parts tooled for interchangeability. Interior completely machined. Improved method of adjustable cushioning eliminates shock. No threads to strip. No parts to freeze.

Send for full details on *HYDRAULIC* and *AIR* cylinders.

PETCH MANUFACTURING COMPANY

2769-71 HARPER STREET
MT. CLEMENS
MICHIGAN

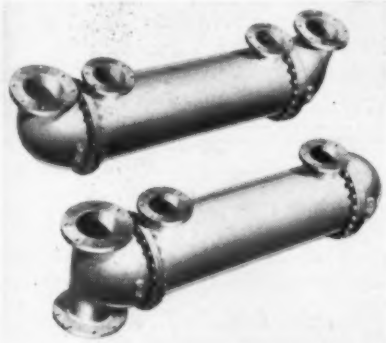
torque through a radius of 280 degrees. Among the advantages are: equal power in both directions (no rod displacement as in conventional hydraulic cylinders); no exposed working surfaces; double sealing by revolutionary new method, making external leakage practically impossible; 90 per cent efficient; and assembly and disassembly without special jigs or fixtures. Both larger and smaller sizes are being developed. *3.*

Fluid Flow Regulator

A simple, self-contained regulator that maintains constant volume of fluid flow under varying pressures is announced by the W. A. Kates Company. The motor, with only one moving part, maintains a constant differential pressure and hence a constant flow. Simplicity is achieved by using the fluid flow for vertical displacement of the regulating element. A control valve adjusts the flow up to 100 gpm in the standard designs. Larger units can be supplied. *4.*

Heat Exchanger

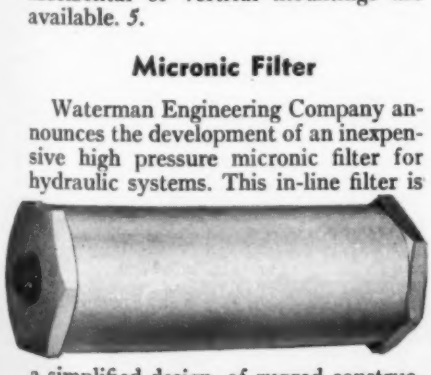
A new type "R" shell and tube heat exchangers especially designed for engine, oil and miscellaneous fluid cooling is announced by the Young Radiator



Company. The line consists of single and two-pass models in a wide range of capacities. Standardized parts simplify tube inspection, the removable tube bundle design making maintenance possible without disturbing the piping. The tubing is composed of non-ferrous metal and is corrosion-resistant to either fresh or salt water. The free floating header with an oil and water resistant seal prevents intermixing of fluids, and allows expansion due to temperature change. Horizontal or vertical mountings are available. *5.*

Micronic Filter

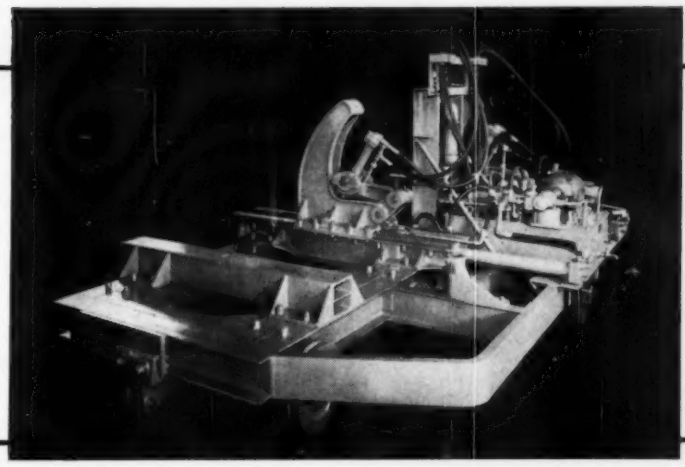
Waterman Engineering Company announces the development of an inexpensive high pressure micronic filter for hydraulic systems. This in-line filter is



a simplified design, of rugged construction and suitable for 3000 psi operating pressure. Replaceable element filters

REMOTELY CONTROLLED POWER FROM GREER ACCUMULATOR

- **Reduces Horsepower Requirement**
- **Saves Time**
- **Eliminates Need for Operator on Carriage**



Huge Hydraulic Pulpwood Carriage and Greer Accumulator.
Photo Courtesy of the Filer & Stowell Co., Milwaukee, Wisconsin

VINCENT R. NOLL
The Filer & Stowell Co.
Milwaukee, Wisconsin . . .

"Filer & Stowell Hydraulic-operated carriages handle 10-ton logs with ease. Two 1000 psi pumps actuate the set cylinders to position the log and to store fluid under pressure in a Greer 5-gallon accumulator. This stored power is released instantaneously to the dog cylinders for gripping the log. Precious time is saved over the same operation where an accumulator is not used. Moreover, accumulator pressure urges the tong dogs toward the closed position, automatically holding the log after it has been dogged. The pumps are then released for use in other operations such as: setting, tapering, or receding."

"In addition, remote control of fluid power made possible by the Greer Accumulator, enables us to eliminate the use of one operator on the carriage. The net result is a reduction in horsepower requirement and a saving of time and manpower."

This is just one of the numerous installations where Greer Accumulators are effecting greater economy, increased production and improved operation efficiency of processes and machines.

If you are now using or plan to use hydraulic equipment, it will pay you to discover what our accumulator can do for you.

We, at Greer, are eager to discuss your particular hydraulic problems. A request for information on your company letterhead will bring an immediate reply. Write Now!

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

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GREER
HYDRAULICS INC.
454 EIGHTEENTH ST., BROOKLYN 15, N. Y.

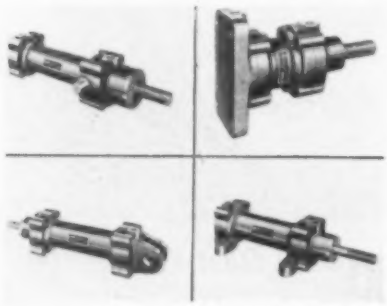
particles as small as 40 microns. Pressure drop is 25 psi at 10 gpm flow using SAE 20 oil. Ports are ⅜ in N.P.T. (dry seal). *6.*

Safety-Relief Valve

An improved Type 2745 bar stock safety-relief valve for pressures up to 10,000 psi has been developed by the Farris Engineering Corporation. Its features include a single blow down ring adjustment, metal to metal seal between body and nozzle, and increased spring area, upgrading calibration. The heavier internal parts are of stainless steel. A gasketed cap and valve body thread are used to withstand high back pressures. There is a wide choice of nozzle sizes. *7.*

Hydraulic Oil Cylinders

A new line of hydraulic oil cylinders, series LA, is announced by Vickers, Inc.

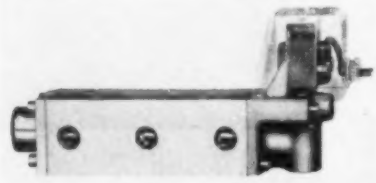


Features of the new cylinders include improvements in head seals, piping connections, self-adjusting packings, universal mounting positions, and other details. Their maximum operating pressure is 1500 psi. Adjustable hydraulic cushions can be provided at one or both ends to decelerate the piston as it approaches the end of its travel. Any reasonable stroke length can be furnished; all cylinders are available with standard or heavy duty piston rods. The cylinder caps can be rotated in relation to the remainder of the assembly so that installation is simplified in limited clearance areas. *8.*

CIRCLE NUMBERS ON THE CARD AND MAIL!

Solenoid Valve

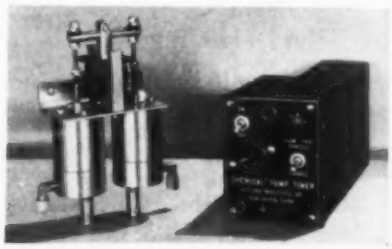
A solenoid-operated single plunger valve for high speed and cycle applications is the newest addition to the Quick-As-Wink line of C. B. Hunt & Son, Inc. To be known as the "SA" line, these valves use a solenoid traveling only ⅛ in to move a pilot plunger. The



released air pressure operates a piston which moves the main valve plunger. The amperage requirement and destructive impact are reduced because of the short stroke. The valves are supplied in 2-way to 5-way designs, sizes from ⅜ to 1 in. *9.*

Remote Control Metering Pump

A new line of remotely controlled metering pumps is announced by Eastern Industries, Inc. An electronically operated solenoid directly coupled to the piston provides variable regulation



to a maximum output of 0.8 cubic inches per stroke. The pump needs no attention once installed as it is self lubricated, and a mechanical sealing arrangement eliminates periodic maintenance. The timer is approximately 9¾ x 4 x 5 in high, pump 6½ x 4½ x 2⅝ in deep. *10.*

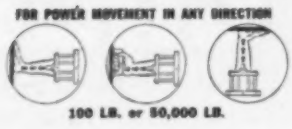
Clinch-Type Fittings

A new "clinch-type" high pressure fitting for use with any type of metal or elastic tubing has been developed by the Crawford Fittings Company. The "Swagelok" fittings provide leak-proof

All moving parts are controlled hydraulically by T-J Cylinders—on this Malleable Nut Production Machine designed and built by Roy Hays & Associates, Rockford, Ill., for the Wagner Malleable Products Co., Decatur, Ill.

It's *fully automatic*—the operator only places nuts in stations. Nine T-J Cylinders, 40 ton to ½ ton, help complete the job of cutting off sprue, sizing, boring, facing, chamfering and threading 2,500-¾ std. pipe thread nuts per hour.

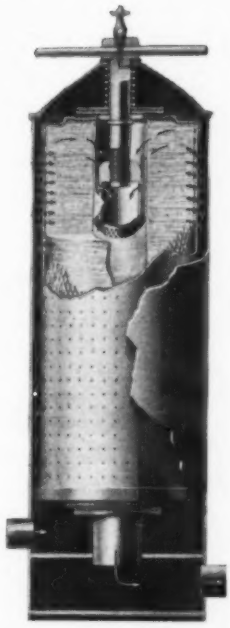
For your tough jobs of power movement —pushing, pulling or lifting—*save labor, speed production* and *cut costs* with T-J Air and Hydraulic Cylinders! Many standard sizes and styles . . . both cushioned and non-cushioned types . . . 100 lb. or 50,000 lb. Precision-built for long-life dependability. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.



T-J
TOMKINS-JOHNSON
RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

33 YEARS EXPERIENCE

REDUCE DOWNTIME *with* HILCO



RP-1

HYDRAULIC OIL FILTERS TO KEEP YOUR OIL CLEAN

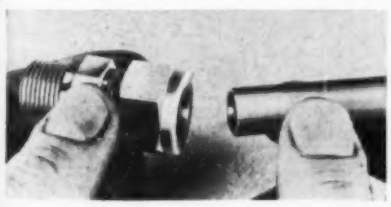
★ A HILCO WILL PREVENT OIL SLUDGING - PUMP AND VALVE FAILURES

WRITE FOR *Free* LITERATURE AND RECOMMENDATIONS

THE HILLIARD CORPORATION, 148 W. FOURTH ST., ELMIRA, N. Y.

IN CANADA . . . UPTON-BRADEEN-JAMES, LTD. 990 BAY STREET, TORONTO . . . 3464 PARK AVENUE, MONTREAL

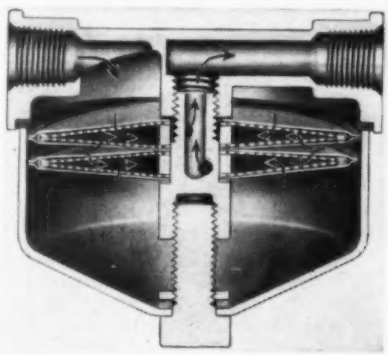
seals at three points. Two ferrules and a threaded chuck clamp around a tube with virtually no effect on the inner walls, permitting completely unimpeded flow. The axial support pulled up in the tube assembly tends to protect the fitting from vibration or fatigue. Assembly is fast and easy, the "Swagelok" is slipped onto the end of a tube and given one-and-a-quarter turns with any standard wrench. No torque or twisting is



transmitted to the tube. The new clinch-type fitting is available in steel and stainless steel, Types 303 and 316, Monel, aluminum and brass in sizes ⅛ to 1 in OD. Connectors, unions, elbows and "tees" are also available. *11.*

Air Filter

The Sparkler Manufacturing Co. has introduced a new type horizontal disc filter which provides a large effective filtering area in a minimum space. Cleaning or replacing the V-shaped filter discs attached to the housing cover is easily accomplished. Various filtering material, such as synthetic rayon non-woven cloth, woven wire cloth or resin treated filter paper are used to cover the leaves of the discs. A wide range of porosity is



achieved useful for separating liquids of different densities, purifying gases, or removing solids of sizes down to two microns from liquids. *12.*

CIRCLE NUMBERS ON THE CARD AND MAIL!

Reservoir Type Manometers

A new line of reservoir-type manometers whose features include minimum mercury contamination and easy cleanout have been announced by King Enginering Corporation. To prevent contamination of the indicating fluid, drain and cleanout plugs are straight-threaded and gasket-sealed, eliminating the use of sealing compound on submerged threads. The glass tube is a chemically-inert synthetic packing ring that slips on and off the tube easily. Both tube and direct reading scale are easily removable. Manometers of this design are available in 14 lengths with scales from 12 to 116 in long, for use on pressures to 200 psi. They can be mounted flush, flat on front of panel, on a wall, or on a bench or table with tripod mounting. *13.*

Constant Feed Gear Pump

A small capacity gear pump, providing 50 cc's per minute at 100 rpm, is offered by Bijur Lubrication Corporation. Because of the small delivery, the

correct quantity required by the machine can be fed without by-passing a high percentage. The gear pump, a high efficiency unit, maintains a constant

(Continued on page 35)

Double Service From Milling Machine

THE POPULAR KEARNEY AND Trecker Milwaukee Model 2HL milling machine can be readily converted to semi-automatic operation to increase, in many cases double, the production of parts. The installation shown in Figure 1 has been widely used in many plants.

Typical of this standard set up is its use for milling aluminum alloy piston rods. One position of a two position fixture is arranged to hold the rough casting, the other to hold the semi-finished casting. The No. 1 fixture is loaded while the table is in the right hand position, while the rod in position No. 2 is being milled. As the table feeds from the right to the left hand position, the side of the connecting rod is faced. During this operation, station No. 2 is unloaded and reloaded and, as the table traverses from the left to the right, the facing operation is performed on the semi-finished part.

The equipment to convert the mill consists of an integral power unit or air motor with solenoid-operated valve (just below the table at the left, Figure 1) and two 18 in stroke hydraulic resistance units, one mounted at each end of the table. The installation can be easily adapted to any similar type of machine tool.

The operator controls the machine through two normally open and two normally closed push button stations. Operating No. 1 push button starts the feed to the right; No. 2 starts the feed to the left. By depressing No. 3 or No. 4 button, Figure 2, the table traverse can be stopped in either right or left position. Once the unit is started, dog operated limit switches reverse the feed. The feed in both directions is positively controlled by the hydraulic resistance units which set up an opposed, steadying force to the push of air. Once the unit is started, the dogs strike limit switches, causing the feed to reverse.

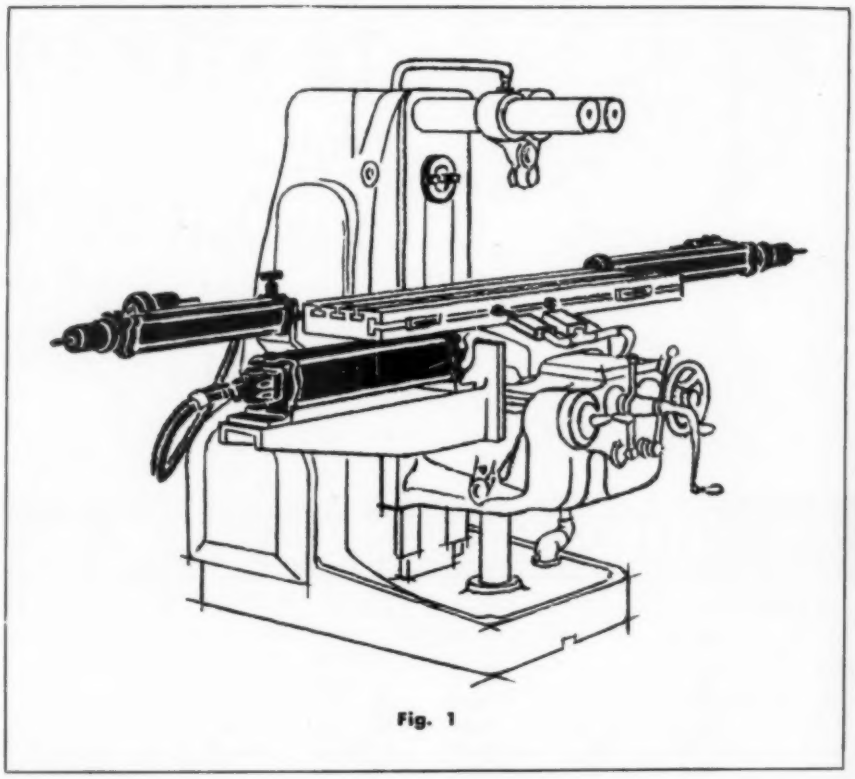


Fig. 1

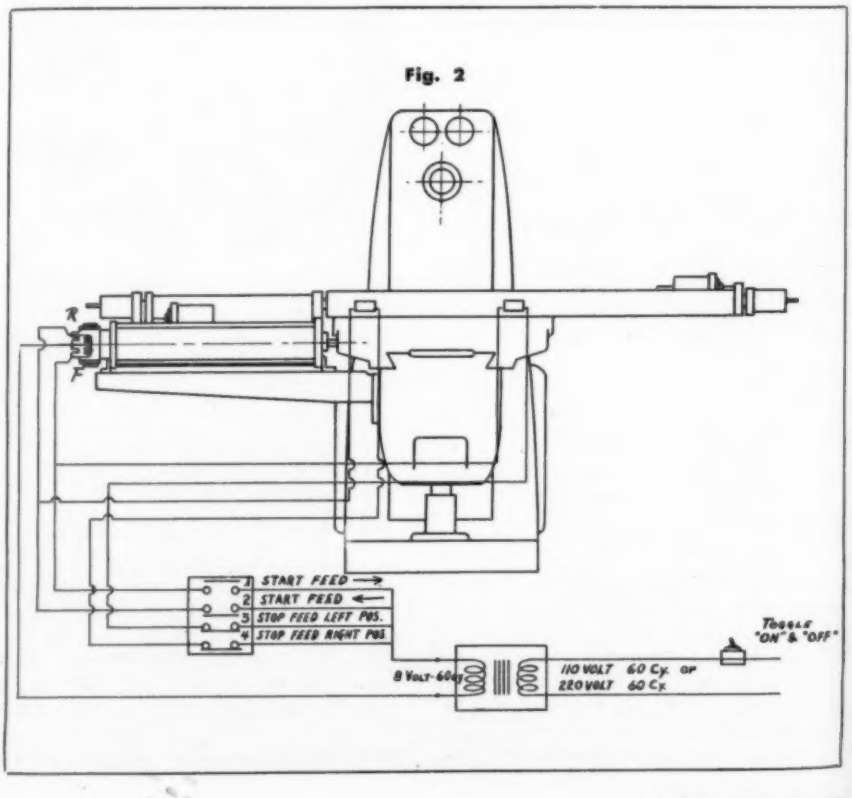


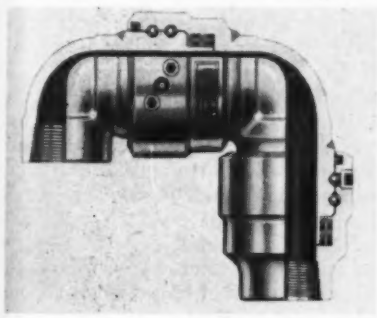
Fig. 2

(Continued from page 33)

feed under high pressure during operation of the machine. Three types of constant feed gear pumps are manufactured: the universal gear pump; the reversible gear pump, which maintains flow in one direction only regardless of change of drive shaft rotation during operation; and the sump type gear pump, which is equipped with an integral fine mesh screen for direct mounting in the sump. Any of the pumps may be used with the Bijur system of metered lubrication. The pumps are readily adaptable to machines where space limitations exist. *14.*

Swivel Coupling

A ball bearing swivel pipe coupling for 360 degree rotation in all planes has been designed by Gil-Lair Products, Inc. The rotating members of the coupling, held together with ball bearings, are

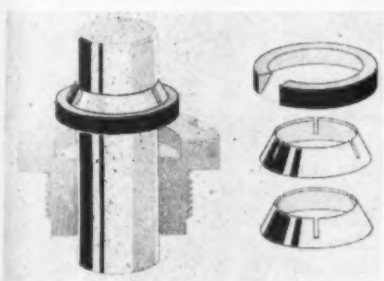


designed for speeds up to 60 rpm. A patented All-Flex double, metal-backed packer assembly renders the unit pressure tight from vacuum to 12,000 psi. It consists of two packers, each a "T" shaped metal backer, bonded to a pair of synthetic rubber lips. High pressure couplings are made of steel; low pressure of aluminum, bronze, malleable iron or steel. They are available in a wide range of sizes, and for working temperatures up to 225 F. *15.*

CIRCLE NUMBERS ON THE CARD AND MAIL!

Metallic Rod Wiper

Hydraulic Accessories Company announces the development of a metallic rod wiper known as Seal-Guard. It con-



sists of two flexible bronze rings, mounted in synthetic rubber, which lift harmful substances off the rod by means of knife-edged conical surfaces. The wipers are self-adjusting due to the action of the rubber on the staggered scraper-rings. Seal-Guards can be had in a wide variety of rod sizes. *16.*

Miller

High Pressure Hydraulic Cylinders

met J.I.C. HYDRAULIC STANDARDS years before their adoption

UNABRIDGED COPY of "Joint Industry Conference" Standards for specifying "quality" hydraulic equipment SENT FREE ON REQUEST

Why Experiment? . . . Specify Miller "Time Tested and Proven" Cylinders—And Be SURE!

***All* Miller Standard High Pressure Hydraulic Cylinders met both the *mandatory* and *recommended* practices of the "Standards" *years* ago.**

Some "Standards" specifications, such as dirt protectors, scratch-resistant piston rods, etc., are required only under severe conditions. *All* Miller *Standard* High Pressure Hydraulic Cylinders met *these* requirements *years* ago.

The desire for elimination of *manual* rod seal adjustment is strongly voiced at all hydraulic industry conferences. The *"time tested and proven"* Miller Patented Rod Seal is self-adjusting and wear compensating . . . *requires no manual adjustment.*

Complete Line

- **AIR CYLINDERS 1½" to 20" Bores**
- **LOW PRESSURE HYDRAULIC CYLINDERS 1½" to 14" Bores**
- **HIGH PRESSURE HYDRAULIC CYLINDERS 1½" to 12" Bores**

Single and Double Acting, Single and Double Rod End, Spring Return, Cushioned and Non-Cushioned, Over-Sized Rod, and Long Stroke Cylinders in All Mounting Styles.

★

See Our Exhibit (Booth No. 735) at A.S.T.E. SHOW, Philadelphia, April 10-14

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Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

28. Handbook of "O" Rings . . . Plastic and Rubber Products, Inc. has just issued their new fourth edition of their handbook on "O" ring hydraulic packings and other special synthetic rubber products. General data on "O" ring seals, design data on non-moving, moving or dynamic seals, special applications and "O" ring gland design and operation are more complete and more logically presented than in former editions. Very complete data on standard and special compounds and rings to meet A.M.S. and AN specifications. Data on ring sizes and groove dimensions are listed for rings which meet J.I.C. HO and HS series. Newly included information includes aniline point of mineral oils, and installation suggestions.

29. Condensed Catalog . . . Very complete specification and performance data of pumps and controls for industrial hydraulic oil systems are given in 48-page Catalog No. 4900 published by Vickers Incorporated. Vane type, piston and motor pumps of single, double, 2-pressure, and 2-stage types are described. "Hydrocushion" type pressure control valves, volume controls, complete listing of directional controls are listed briefly with basic specifications. The Vickers line of hydraulic motors, cylinders and variable speed transmissions are also covered.

30. Rotary Feed Table . . . A rotary work feed table for drill presses, arbor and impact press rams and other machinery is described in Bulletin T-25 just issued by The Bellows Company. The unit consists of a 10 in diameter table rotated and indexed by either a mechanical or electrical operated Bellows Air Motor at any pressure up to 175 psi. The standard table is adjustable to 4, 6, 8, 12, or 24 positions.

31. Air Equipment . . . The C. A. Norgren Company describe their line of lubricators in a leaflet, Form 424, which is a condensed listing of their products. Lubricator units, air and liquid pressure regulators, relief and check valves, hose assemblies and re-usable couplings are listed. Several types of combination lubricator units are also shown. Special gas regulators for butane, propane and carbon dioxide are part of the line of valves, governors, blow guns and hose couplings described.

32. Hydraulic Tables . . . A new edition of "Hydraulic Tables", Bulletin 300, is announced by The Baldwin Locomotive Works. Containing 36 pages, it includes tables of hydraulic ram capacities, displacements of single-acting plungers, water flow rates, and friction losses of fittings. It gives conditions for the use of accumulators, pumps, intensifiers, and shock valves. Data on strength of structural materials, properties of sections, moments of inertia, coil spring designs, and other tables will be of interest to designers and users of hydraulic equipment used for load producing purposes.

33. Steel Tubing . . . Applications and properties of Bundyweld Steel Tubing are given in a fabrication information booklet published by the Bundy Tubing Company. Uses of the tubing in fuel lines, lubrication lines and hydraulic lines of gasoline or diesel powered equipment, including agricultural and earth moving equipment, are suggested. Data is included on mechanical properties, corrosion and fatigue resistance and fabricating procedures. Standard sizes of Bundyweld, annealed and cold drawn, in straight or coil lengths are listed. Data on serpentine bends is included.

Champion

uses **HONAN-CRANE** for

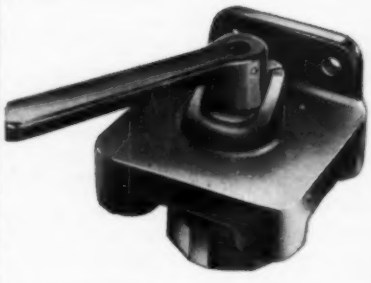
HYDRAULIC OILS on HYDRO-TELS

Champion Machine and Forge Company, Cleveland, uses Honan-Crane oil purification equipment to keep hydraulic oils clean in Champion's nine Hydrotels used for die-sinking.

Honan-Crane is also called on for oil purification in the 1,500-ton hydraulic presses used to trim Champion's forgings. After one and one-half years continuous operation—no noticeable sludge.

For full information on low cost purification and maintenance of hydraulic oils, write Honan-Crane Corp., 102 Wabash Avenue, Lebanon, Indiana, subsidiary of Houdaille-Hershey Corporation.

AIR CONTROL VALVE



- ROTARY TYPE
- HAND LAPPED
- ¼" PIPE PORTS
- 3- or 4-WAY
- LOW-PRICED

Thousands of N. P. hand operated Control Valves are controlling air pressure on buses, street cars, subway and elevated cars, where their dependability is essential to the safety of passengers.

Quantity production of this high-quality valve makes possible its unusually low price. For complete information, write for Bulletin No. DC-204

NP

NATIONAL PNEUMATIC CO., INC.

Industrial Division

Boston • Graybar Bldg., New York • Chicago

Pneumatic Specialists Since 1904

34. Air and Hydraulic Cylinders . . . The Hydro-Line Manufacturing Company has just published a new catalog covering both their air and hydraulic cylinders. Specifications are listed for hydraulic cylinders 1½ to 8 in bore for working pressure to 1500 psi and special cylinders for operation to 5000 psi; also for air and low pressure hydraulic cylinders are shown. Ample illustrations and cutaway diagrams show the construction features.

CIRCLE NUMBERS ON THE CARD AND MAIL!

35. Lubricating Units . . . Self-contained lubricating units—compact oil circulating and filtering systems—are described with complete specifications in Bulletin 829, issued by Bowser, Inc. Dual self-contained systems are particularly recommended where quantities of sludge, water or other foreign substances are present in the oil. Use of two receiving tanks permits precipitation of one batch of oil while oil in the other tank is circulated. Auxiliary equipment and installation setups are shown.

36. Piston Rings . . . Hunt-Spiller Manufacturing Corporation has brought out a leaflet on their double acting piston rings for air pumps and compressors. Because of the three-piece construction and dwelling of pieces in position, the rings, when installed, act as two rings and seal in both directions of the stroke. The rings may be installed as new or as replacement equipment. Installation on new equipment is simplified since only one groove has to be machined around the head.

37. Hydraulic Equipment . . . A recent issue, Volume 2, Number 4, of the Denison Engineering Co. house organ contains a summary of the hydraulic equipment they make. Data on hydraulic pumps for operating pressures to 5000 psi and outputs to 35 gpm, in sizes 3 to 128 hp, 4-way directional and pressure control valves are included.

38. Pressure Valves and Strainers . . . The A. W. Cash Valve Manufacturing Corp. has brought out a 32-page catalog, D-14, covering their line of pressure reducing, regulating and relief valves for use with oil and air. The Cash Acme line of strainers, Types S and SY, for liquids and gases are described with complete specification of screen details. Pressure relief valves featuring an adjustable, easy reading setting are illustrated. Size data and list prices are shown.

39. Pressure Seals . . . Bulletin No. 5, published by Sealol Corporation gives full data on their Series 30,000 mechanical seals for rotating shafts. The "balanced pressure" feature eliminates heavy spring loading and controls seal face pressure within safe limits. The "Sealol" seal will handle pressures in excess of 1000 psi, surface speed over 10,000 fpm and temperatures up to 500 F. Sealol CB, a self-contained shaft, seal and Sealol MM, an oil or grease retainer, are also described.

40. Riveting Equipment . . . The use of hydraulic pressures to 5000 psi for high speed production operations is the subject of Bulletin 150, Hy-Power Hydraulics, just issued by the Hannifin Corporation. Portable and stationary riveters for cold riveting, presses and punches are illustrated indicating the variety of applications possible. There are two basic sizes of hydraulic pressure generators. Each type consists of an electrically controlled, hydro-mechanical, multi-valve unit. The power cycle is shown in a series of diagrams. The generators supply a primary pressure of 1000 psi stepped up to 5000 psi by use of an intensifier. Specifications and means of determining proper sizes are included.

41. Solenoid Catalog . . . A complete line of solenoids, general purpose, high speed, long stroke, double plunger and others, and a line of recipromotors are described in a catalog of the Trombetta Solenoid Company. Instructive information for use of the solenoids with alternating or direct current, pull characteristics at various stroke lengths and number of strokes per minute is included with diagrams. A section gives classifications and characteristics of recipromotors useful for remote control installations and for fast response with rectilinear or angular motion.

42. Small Compressors . . . Bulletin GC-50 issued by Schramm Inc. describes their complete line of 1/3 to 5 hp single and two-stage compressors for industrial purposes. These two types of compressors operate at 150 and 200 psi respectively, and are designed for continuous, heavy duty operation. Output capacities range from 2 to 20 cfm. Applications are suggested for use with air hoists, hydraulic lifts, standby and maintenance use. Complete specifications and illustrations of horizontal and vertical tank, base with motor and separate compressor unit models are included.

"O" RINGS Since 1941

Plastic & Rubber Products Co. ***of Los Angeles*** has for these many years been successfully making commercial and aeronautical "O" Rings for the hydraulic and pneumatic industries.

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of Los Angeles

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Ledeen heavy duty cylinders helped do this job better

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APPLICATION—Concrete material, used in making blocks, must be drawn from hopper, accurately metered, transported and fed to the block mold. A Ledeen heavy duty cylinder, 3" diam. x 20" stroke performs these operations in one motion. Action is simple, controlled by a hand valve.

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Basic Hydraulics Questions, Chapter 5

1. Explain the principle of the gate valve.
2. What are the disadvantages of the gate valve?
3. In what ways does the globe valve differ from the gate valve?
4. What advantages do needle valves offer over gate valves?
5. What is the purpose of a check valve?
6. What is the purpose of a relief valve?
7. What are some of the indications of relief valve trouble?
8. Name some of the causes of relief valve trouble.

REDUCING BLOCK MAKING COST

(Continued from page 14)

bearer. The operator who keeps the unloading rails clear of ejected finished blocks has plenty of time to watch the operation of the machine.

The mold area itself is self-contained in a platen frame which can be moved in and out of the press by simply removing 4 corner bolts on the top platen and bottom platen. The molds are the suspended core type. The mold cores can be removed and new cores installed in approximately two hours. It is not necessary to use cored pallets for each block with this type of mold. A standard 18x18 inch pallet is used for each charge of the press, no matter which combination of blocks are molded.

The plain solid pallet is flexible and very much more economical. Previously it was necessary to provide cored pallets, one for each piece and type of block molded through a day's run. When 1000 pieces were run in a day, it was necessary that 1000 cored pallets be provided. The saving possible with the solid pallet runs into thousands of dollars alone.

The McCray & Daniels organization has been very well pleased with the results obtained with their hydraulic block making machine. Production on a 5 hour operating day has equalled or surpassed previous production from two machines operating on an 8 hour day. Increased production has been achieved with a smaller work crew, at less effort and with reduced spoilage. The time saved has freed operators for other tasks. The unit cost per block has been reduced an average of over 20 percent, a critically important fact in a highly competitive field.

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THEORY AND APPLICATIONS OF HYDRAULIC SYSTEMS

(Continued from page 28)

$$\text{Volume capacity, gpm} = \frac{\text{Displacement, cu in rev} \times \text{Speed, rpm}}{231 \times \text{hydraulic efficiency}}$$

When direction control is needed a circuit designer has a wide variety of characteristics to select from, both as to the internal porting of the oil and as to the external means of control. The principal types of control for these valves are: (1) manual, by foot or hand operated lever; (2) electrical, by electrical solenoids; and (3) hydraulic, in which an external mechanically or electrically operated pilot valve actuates the main four-way valve by oil pressure. In a reciprocating hydraulic cylinder setup it is necessary to take into account the time required for the operation of the four-way valve. The volume of oil required for a given number of cycles per minute may be calculated by the following:

$$\text{Actual volume capacity, gpm} = \frac{\text{Theoretical vol, gpm} \times 60}{60 - \text{time lost, seconds}}$$

The question frequently arises, in connection with the design of production machinery, as to how completely automatic the new equipment shall be. The question is a very involved one and can be answered only by a study of comparative costs of the extra equipment balanced against the added salability or value of the equipment. The fact is that every year more and more completely automatic process machinery is built, indicating that industrial interest in complete mechanization is steadily increasing. In many cases the saving in labor costs are such as to make the additional initial costs of the added controls of little consequence.

The hydraulic fluid used for the transmission of power is another component of the hydraulic circuit. This fluid should be the one specified by the manufacturer of the equipment. Ignoring such recommendations often results in damaged pumps and poor control. An SAE specification number does not assure that the buyer will get all of the desirable characteristics of a good hydraulic fluid. The oil must be such that air, water or dirt will separate out quickly and completely. Fire resistant fluids developed in recent years are available. However, in using such fluids, it must be determined whether or not the seals of the various hydraulic components will be damaged by the fluids. In many cases special seals must be used.

Pipe sizes should be strictly reviewed to be certain that fluid velocities are not abnormally high.

While only the barest mention of the various problems most frequently encountered in designing a hydraulic circuit have been made, an effort has been made to point out the most essential.

This is the first of a series of short articles on the conferences or seminars held by the Committee on Hydraulic and Pneumatic Systems. One of these digests of material covered will be published each month.

BASIC HYDRAULICS

(Continued from page 18)

exposed to damage. They should be accessible, and it should be possible to open them fully. Valves should not be installed where they must carry the weight, sag or expansion of a line.

Valves should be in closed position during installation. Operating parts are less likely to become twisted and areas of closure are protected. Overlength threading should be avoided on the joining pipe to prevent projection of the pipe end into the valve and injury to the valve seat. Sealing compounds, when used, should be applied only to the pipe threads. The pipe should be thoroughly cleaned before a valve is installed and blown out again with compressed air after installation. In attaching a valve, the wrench should be used on the hex nut nearest the pipe to which the valve is being connected. The packing in a new valve should be tightened after it has been in use for a short time, but it should not be allowed to become tightly compressed.

Open and close the valve *slowly*. Do not force the disc against the seat. If a valve refuses to seat properly, open it slightly so that sediment on the seat will be flushed away. If it still fails to seat, the system must be shut down and the valve disassembled to locate and correct the trouble. Valves that have been shut when hot should be tested for closure after the system has cooled.

Inspect all valves regularly. Do not turn a valve stem with a wrench. Valves of all kinds should be tested at least four times a year.

In disassembling, be sure the valve is open. Do not use a long handled wrench, a short wrench and a few light hammer taps over the threads are more effective and will not twist the valve.

Use only proper tools for reassembling and again be sure the valve is in open position. Acquaint yourself thoroughly with the construction of the valve before putting it together. Repair parts should be ordered by the serial number of the valve, its size and type, the name of the manufacturer and if possible, the name and parts number of the valve.

The successful operation of a hydraulic system depends upon the proper operation of the valves in the system. The operator should know what valves must be open and what valves closed. If the system has been operated previously, the automatic valves such as regulators, relief valves, safety and other valves should not be disturbed until found faulty or until time for periodic checkup. Always check up on the open or closed position of all hand operated valves before starting the system.

Improper action of a hydraulic system can often be traced to faulty valve action. This is usually due to the presence of foreign matter in a valve seat, to the scoring or grooving of meeting parts or to the plugging of openings. As a result the valve may stick or may fail to close completely, so that the system registers low or fluctuating pressures or no pressure.

Chapter VI, Compound and Pressure Reducing Valves, will be begun in the next installment. Preserve all installments for future reference. Questions covering Chapter V will be found on page 38.

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Easy as A, B, C - -

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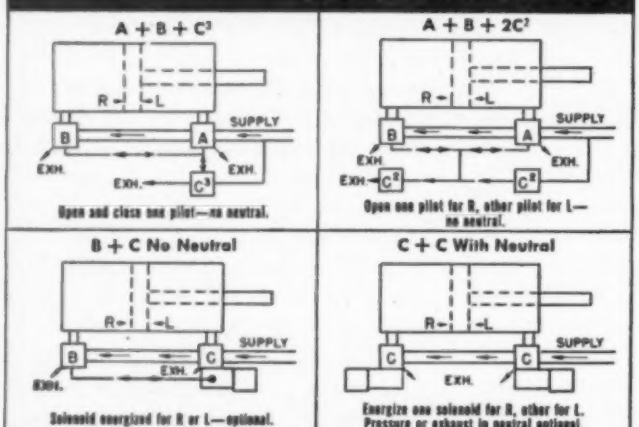

A – L3A Numatics Valve
B – L3B Numatics Valve
C – SL3 (L3A with solenoid pilot attached)
C² – Two-way pilot valve
C³ – Three-way pilot valve

Shown here are a few typical combinations obtained with "Unitized Control" . . . applied directly to the air cylinder.

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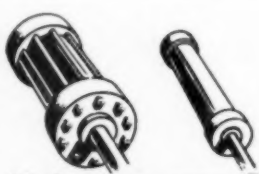

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APPLIED HYDRAULICS DIGEST

Abstracts, summaries and listings of articles on hydraulic and associated applications in industry; reports on prepared papers, talk and discussions pertinent to the hydraulics field.

Development of JIC Industrial Hydraulics Standards

R. R. Mitchell, Don P. Morrell and **James Robinson,** *Tool Engineer,* v 24, January 1950, pp 17-23.

These excerpts from papers delivered at the symposium on hydraulics of the Detroit chapter, ASTE, on September 8, 1949, cover the general theme of the development of the JIC Hydraulic Standards for Industrial Equipment. Mr. Mitchell, executive secretary of the JIC from the start, reviewed the origin and history of JIC; Mr. Morrell, supervisor, standards and control applications, production engineering, Ford Motor Co., spoke on the benefits which JIC have brought to users and illustrated his talk with some very excellent "before-and-after" photographs; and Mr. Robinson, chief engineer, Vickers, Inc., and chairman of the Hydraulic sub-committee, National Machine Tool Builders Association, talked on the advantages which JIC have brought to the machine tool builders.

How Hydraulics Powers Earthmoving Machines

E. J. Hrdlicka, *SAE Journal,* v 58, January 1950, pp 38-41.

A digest of the paper, "Hydraulic Power as Applied to Earthmoving Equipment", delivered by Mr. Hrdlicka at the SAE National Tractor Meeting, Milwaukee, September 13, 1949. Applications to bulldozers, tractor shovels, scrapers, loaders and graders are described and illustrated. The development of improved hydraulic components for these classes of equipment is pointed out.

Production of Seamless Steel Pipe and Tubes

Bryant Bannister, *Steel,* v 125, October 17, 1949, pp 86, 88, 91, 94, 96 (part 1) and October 24, 1949, pp 68, 70, 72, 74 and 76 (part 2).

The description and step-by-step drawings and illustrations of the procedure in the manufacture of seamless steel pipe, using a roll-type piercing mill, are excellent and can be followed easily. The first six steps, to include passes of the bloom in a bar mill, are common to most steel making. However, to prepare the round bar for piercing, a cup shaped cavity is impressed in one end of the bar while hot; the rounds are cooled, inspected and conditioned, then reheated in a roll-down or rotary hearth type of furnace, then pierced.

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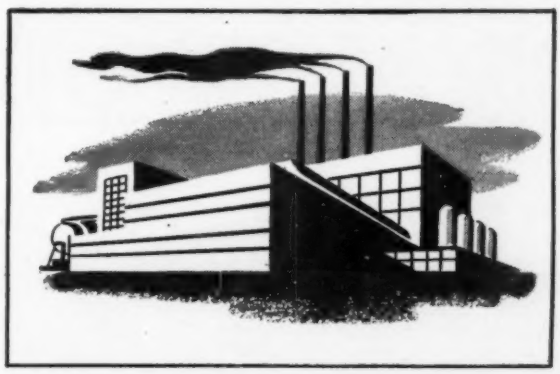

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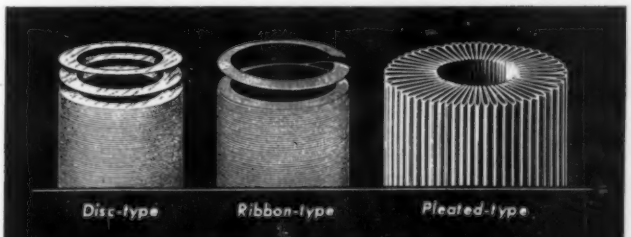

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AIR AND HYDRAULIC CONTROL VALVES

The piercing operation employs the so-called "geometric pass", invented by the author and now used by substantially all seamless steel pipe manufacturers. The pass is the combination of the two power driven barrel shaped rolls whose axes are in planes parallel to but inclined in opposite directions to the geometrical axis of the mill to provide a feeding effect for the bar which is squeezed and rotated between the rolls. Two stationary guide shoes above and below the bar locate it in proper vertical position and limit radial flow of the metal. A piercing point, located slightly ahead of the gorge (narrowest part of the pass) is supported on the forward end of the thrust bar which is free to rotate but is restricted from longitudinal movement. When the rear of the bar has advanced through the pass, a thrust bar is withdrawn and the bar is "kicked out" of the piercer outlet and transferred to a reheating furnace. Large pipe diameters, greater than 4½ in, are customarily double pierced. The pierced rolls are then processed through a plug rolling mill, a unit comprising a pair of horizontal grooved driven rolls vertically in line, a thrust bar and a pair of stripper rollers driven in a direction opposite the main rolls. A hydraulic wedge provides larger vertical movements, a hand operated screw the fine adjustments. A pusher air cylinder rams the round into the pass, the rolls compress the shell against the plug. The shell is rotated 90 degrees and given a second pass over the plug, after which the shell proceeds to one of two reelers arranged in parallel, where surface irregularities are smoothed out and both inside and outside surfaces of the shell are burnished.

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For pipe 16 in and larger in diameter an additional operation, on an expanding or rotary mill, is included. This operation, much like the piercing one, reduces the wall at a rate sufficient to provide for the expansion of the shell without prolonging it. From the expanding mill for large pipe and reels for all pipe, lengths are passed through a tunnel type furnace to a sizing mill, then rotated slowly over a cooling table until the pipe reaches approximate room temperature.

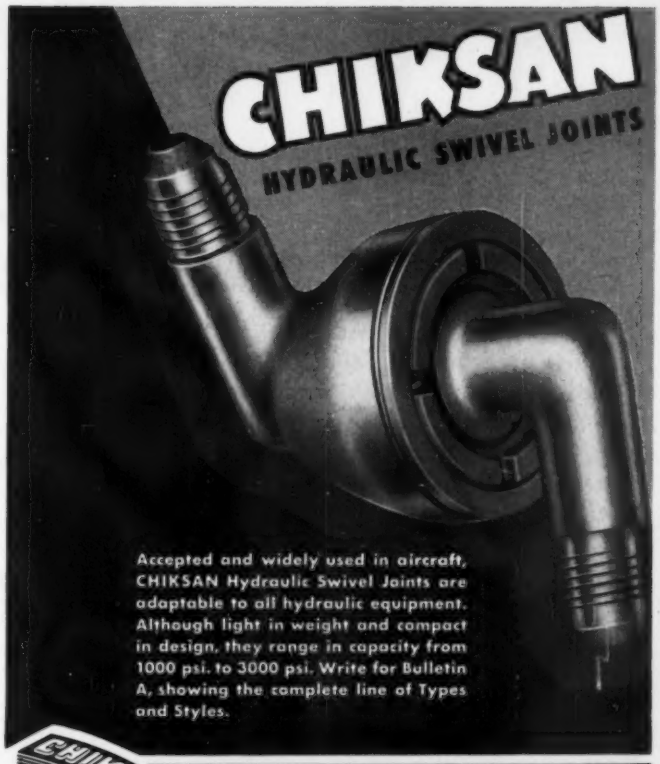
Dimensions of tools for producing single and double length tubes are given and a stretch reducing mill is described, as also are a screw type cooling table for tubing, and a so-called continuous tube rolling mill.

Hydraulic Conversion Of Disk Grinder

John C. Hanna, *American Machinist,* v 93, December 15, 1949, pp 86-87.

A standard Besly disk grinder on which small brass, bronze and aluminum alloy parts for valves were made was converted to a miller to increase the machine cycle, eliminate one grinding job on each part and to utilize quick-acting fixtures. Relatively inexpensive changes were required, the hydraulic cylinder with valves and switches was installed at the left hand table of the machine to connect to the table mechanism near the counterweight. A double-row type of bearing was added to the opposite end of the machine spindle to handle the extra axial load. Removable pot fixtures, that can be used to hold the parts for precision boring operations at another machine, hold the round castings that

(Continued on page 45)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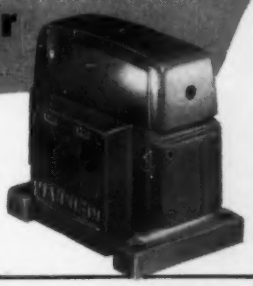

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Barksdale Valves, a new company with quarters at 4905 Sante Fe, Los Angeles, Calif., has been formed to produce "Shear-Seal" valves for industrial applications, according to a statement by L. S. Barksdale, president of Saval, Inc. The move was made to provide separate facilities for non-airborne valves, since the entire facilities of Saval, Inc. are now required for the production of aircraft and related units.

The William E. Summerbell Co. has been appointed Washington (D. C.) representative for Logansport Machine Co., Inc.

Plastic and Rubber Products, Inc., Dayton, Ohio, announces the appointment of Airsupply Company, a division of the Garrett Corporation, as West Coast distributor for "O" ring seals. Airsupply will carry a wide range of "O" ring seals in stock and will work with customers' engineers on application problems.

Rockwell Mfg. Co. has acquired the rights to the automatic air hydraulic drill head formerly manufactured by the Cleveland Republic Tool Corporation.

Robert A. Fitch has been named chief fuels and lubricants engineer, industrial products engineering, Gulf Oil Corporation. With the Gulf Corporation for over 16 years, Fitch has served as industrial lubrication engineer in the Rochester, Brooklyn and New York division offices.

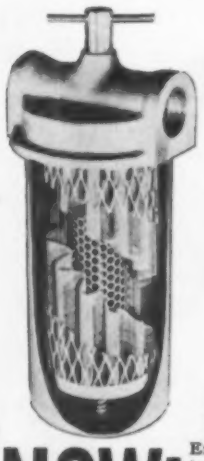
Greer Hydraulics, Inc., announces the appointment of Kevin G. Winker as sales manager and of Ted Brick as district sales manager of their Dayton district. Sumner L. Barton, formerly in Dayton, has returned to the home office in Brooklyn.

D. M. Berges has been appointed chief engineer of the Pesco Products Division of the Borg - Warner Corporation, according to an announcement just released by R. J. Minshall, president of Pesco. The appointment fills a vacancy existing since J. A. Lauck was elected vice president in charge of engineering several months ago. Mr. Berges will be in charge of the extensive and modern research facilities which are a part of the new Pesco plant in Bedford, near Cleveland. He has been serving as chief engineer of Pesco's Electrical Section since 1943.

Mr. Berges

J. Edward Goss, industrial activities administrator of Brown & Sharpe Mfg. Co., has been reap-

(Continued on page 48)



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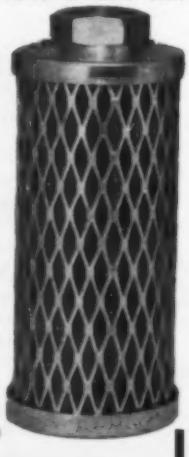

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Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. Now ONLY 17.50

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Self contained, 2 H.P. constant torque at all speeds with variable volume reversible piston pump (controlled by outside lever,) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/2 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 27.50

BENDIX HAND PUMP

Provides an instantaneous source of tremendous power for almost any heavy work. Double action stroke. Delivers .30 cu.in. per cycle at 3000 PSI. Maximum pressure 5000 PSI. Has built-in reservoir with 2¼ qts. capacity. 3/8" pipe outlets and pressure release valve. Base is 7¾" diameter. Pump is 23 3/16" overall height. Weight 15.2 lbs. A $40.00 Value 15.95
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Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW 14.49

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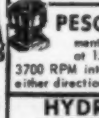
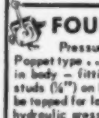
HP-3V-HAND PUMP – Operating pressure 2000 PSI. Capacity, 1.5 cu.in. per complete cycle. Has added feature of a diverter valve for selecting a suction & pressure port for two independent systems. . . . . ONLY 12.75

PESCO PUMP



Positive displacement gear type. Capacity: 1 gal. per minute at 1500 RPM at 1500 PSI. Operating speed: 3700 RPM intermittent max. 4500 RPM. Rotations: either direction with slight adjustments. 9.49

FOUR WAY VALVE



Pressure balanced Off at neutral positions. Poppet type . . . Port size 1/8" standard pipe tapped in body – fittings adapt to ¼" tube included. Four studs (⅛") on back of valve for mounting. Block may be tapped for larger pipe size. Will handle hydraulic pressure 1500 PSI continuous. Tested at 3000 PSI. . . . . NEW 6.75

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This fine Logan power unit delivers 5.5 GPM at 500 PSI. Complete with relief valve, gauge and snubber. 1 HP compound wound motor. 1950 RPM 24V DC. Compact, streamlined unit mounted on cast iron tank. Heavy duty plumbing. Entirely covered. Excellent condition. 64.95

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(Continued from page 43)

are machined into valve disks. Disks up to 3 in dia can be handled. The hydraulic conversion gives an automatic feed cycle, controlling rapid traverse of the table up to vertical position, slow feeds for cutting and rapid traverse return.

Give Life to Hydraulic Systems

A. G. Bergstrom and **R. Q. Sharpe,** *Machine Design,* v 22, January 1950, pp 80-86, 154, 156.

A review of the characteristics of petroleum base hydraulic fluids and of some of the major additives used for specific service conditions. The importance of design and maintenance of hydraulic systems is emphasized and suggestions covering sealing, hose and gasketing materials, air in the system and vibration are given.

How Incentives Help Us Halve Our Lubrication Costs

F. F. Twomey and **W. G. Weeks,** *Factory Management and Maintenance,* v 108, January 1950, pp 80-83.

A survey of the lubrication system in operation at the Passaic plant of U. S. Rubber Company by the manager and the industrial engineer, Wage Standards Department, of that plant. A survey was made of the 4000 production machines which averaged about 10 lubrication points per machine, the proper lubrication for each service and frequency most desirable was worked out and the system standardized by a master lubrication record. All maintenance and lubrication men follow schedules which must be strictly followed.

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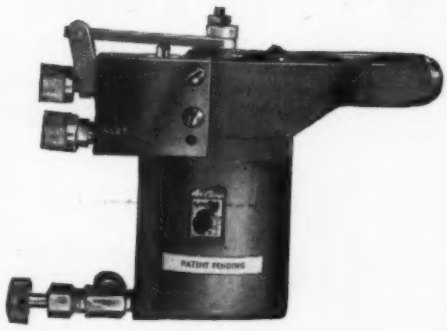

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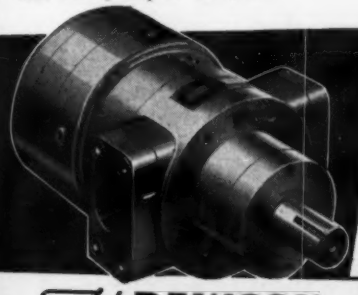

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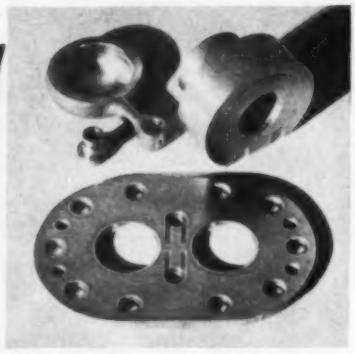

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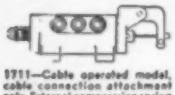
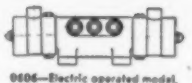
Twenty different left end attachments are available for use with each of 14 Modernair basic valve models — nine of which are illustrated below. In all, nearly 280 distinct valve combinations may be produced using the basic body casting in either ⅜ or ¼-in. pipe size.



1711—Cable operated model, cable connection attachment only. External compression spring return. (Opposite 02)



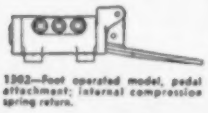
0606—Electric operated model, solenoid controlled secondary valve attachment. Solenoid electric controlled return.

1401—Foot operated model, treadle attachment; manual setting.

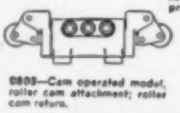
1302—Cam operated model, cam stem attachment; internal compression spring return.

1606—Hand operated model, palm attachment; single coil electric controlled return.

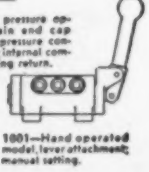
0502—Pilot pressure operated, plain end cap tapped for pressure connection only; internal compression spring return.



1302—Foot operated model, pedal attachment; internal compression spring return.



0803—Cam operated model, roller cam attachment; roller cam return.



1001—Hand operated model, lever attachment; manual setting.

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Modernair TRADEMARK CORPORATION

4222 HOLLIS STREET • OAKLAND 8, CALIF.

Supervision is held to a minimum but each day's work report is signed by a foreman, the plan paying for performance, not for actual hours worked or length of service. Records summarize advantages which include: halving lubrication labor costs; reduction of supervision; savings due to standardized lubricants; simplified training and replacement; and almost entire elimination of machine breakdowns due to poor lubrication.

Tests Prove Operating Ease of Non-Lubricated Cylindrical Plug Valve

Anonymous, *Instrumentation,* v 4, fourth quarter, 1949, pp 23-24.

A review of the tests made on the new non-lubricated cylindrical plug valve developed by the Belfield Valve Division of the Minneapolis-Honeywell Regulator Co. in their house organ. Details and a graph on the torques tests made, cross section and schematic diagram give a very adequate picture of the performance characteristics of this type of valve.

Engineering Oil Seals to the Product

R. S. Rainey, *The Tool Engineer,* v 23, October 1949, pp 29-31.

Since the introduction of synthetic rubber sealing members the standard type oil seal has gained a considerably larger field. While leather still retains advantages, particularly where starving of the seal area occurs, the greater homogenousness of synthetic rubber, its lighter torque and greater flexibility for intricate shapes, has won many applications. The major dis-

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GENERAL FILTERS, Inc.
12890 WESTWOOD — DETROIT 23, MICH.

advantage of synthetic rubber oil seals is that they require lubrication at all times. The manufacturing variables are listed, types of seals (spring-loaded sealing members, metal cased, spring-loaded, flex seal, springless, single sealing members, with and without steel support, dual member seals, end or face type seal and two categories of special seals) and considerations involved in oil seal design.

No More Skids for Airplanes!

Arthur J. Bent, *SAE Journal,* v 58, January 1950, pp 63-66.

An abstract of the paper, "Aircraft Decelostat—A Device for Wheel Slide Protection", presented at the SAE National Aeronautic Meeting, Los Angeles, October 8, 1949. A detailed description of the design and operation of the Decelostat controller, similar to one long used successfully on railroad cars to avoid flat wheels, is given. It can be applied to both pneumatic and hydraulic brake systems and to any type or size of wheel or brake. Fundamentally, the operation of the device is based on the relation of the deceleration rate of an energy wheel to the deceleration rate of the airplane landing wheel or axle. Under normal landing conditions, the energy wheel in the decelostat synchronizes with the landing wheel; when the rate of retardation exceeds a predetermined value, the energy wheel will overtravel, operating a valve to interrupt the brake pressure and release the brakes. Brake pressure is restored the moment the landing wheel resynchronizes with the energy wheel. Charts show characteristic dry and wet runway stops for the B-26HM with tandem gear, using one Decelostat controller per wheel.

History of Machine Hydraulics

H. G. Conway, *Machine Design,* v 21, November 1949, pp 106-107.

Part 1 of a series considers air hydraulics and describes in detail the design of Hero (c 150 B.C.) to open and close temple doors by means of displacement of water in a closed vessel by means of air heated by an altar fire. Displaced water is syphoned into an open vessel connected to ropes wound around vertical shaft extensions of door hinges. Ropes are wound in opposite directions on the two shafts and held by a counterweight. When a fire is lighted the displaced water is syphoned to the open vessel, the weight turns the shafts, opening the doors. When the altar fire is extinguished, the air cools, water syphons back and the counterweight closes the doors.

A Basic Approach to Servomechanism Design

Richard Herst, *Electrical Manufacturing,* v 44, December 1949, pp 80-85, 190, 192, 194.

A clear, easily understood approach to the servo, illustrating characteristics in terms of human reactions, the relation of speed, accuracy and stability in terms of circular graphs. Three types of servos commercially available, reversible motor, clutch and clutch-brake are introduced with series of schematic drawings to illustrate operation and characteristics. Advantages and disadvantages and applications of each type are given or suggested.

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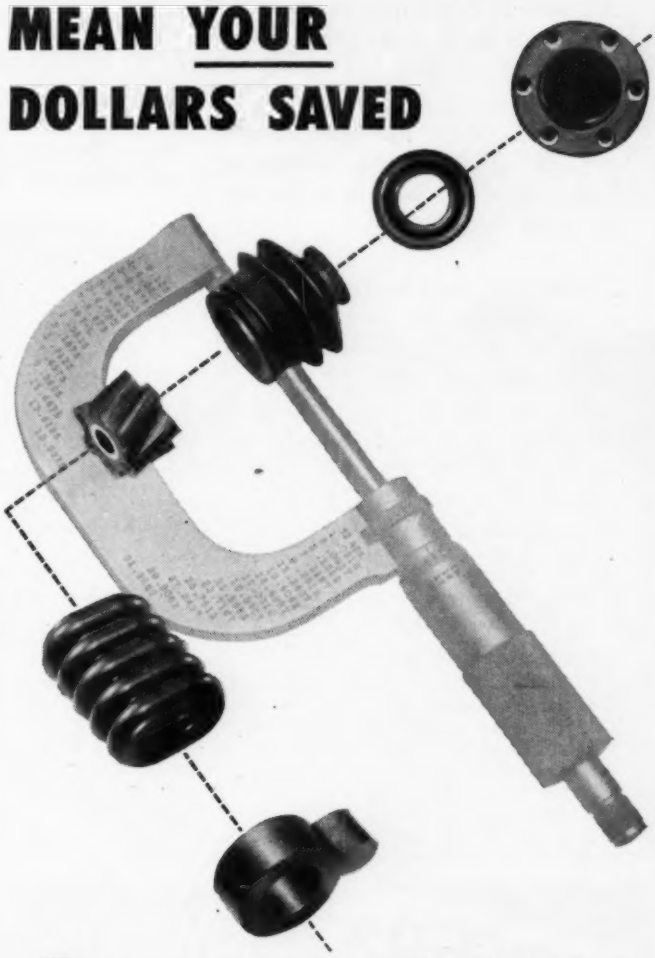
MEAN YOUR
DOLLARS SAVED



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(Continued from page 44)

pointed to the chairmanship of the Apprentice Training Standards Committee of the National Machine Tool Builders Assn.

Fred L. Hopf has been named general manager of Dynamatic Corp., Kenosha, Wis., a subsidiary of Eaton Mfg. Co.

Edward L. Asch has been appointed manager of the recently established Houston, Tex., office of Vickers, Inc. He made the move from the New York area where he worked on both aviation and industrial machinery applications.

F. P. Taugher has been named manager of engineering of the Industrial Control Division of the Westinghouse Electric Corporation at Buffalo, N. Y.

Laurance H. Cooper, vice president and general manager of Pacific Airmotive Corporation, Burbank, Calif., announces the appointment of Sir George Godfrey & Partners, Ltd., Montreal, as Canadian representatives.

P. H. "Phil" McManus has been appointed general sales manager of Templeton, Kenly and Company, according to an announcement by J. B. Templeton, president.

Charles G. Keshen, 18 Boulevard Terrace, Allston 34, Mass., has been appointed manufacturers' representative by Hose Accessories Company for all of New England except New Hampshire.

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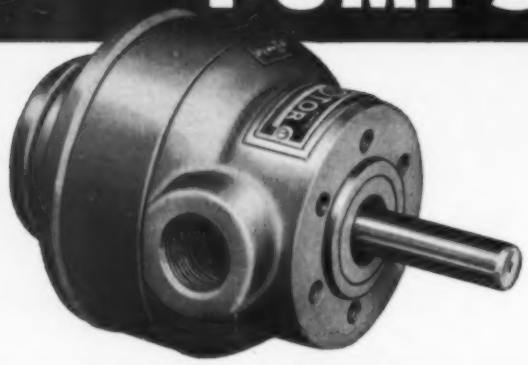
GEROTOR hydraulic PUMPS



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Sizes: ¼", ⅜", ½", ¾", 1"

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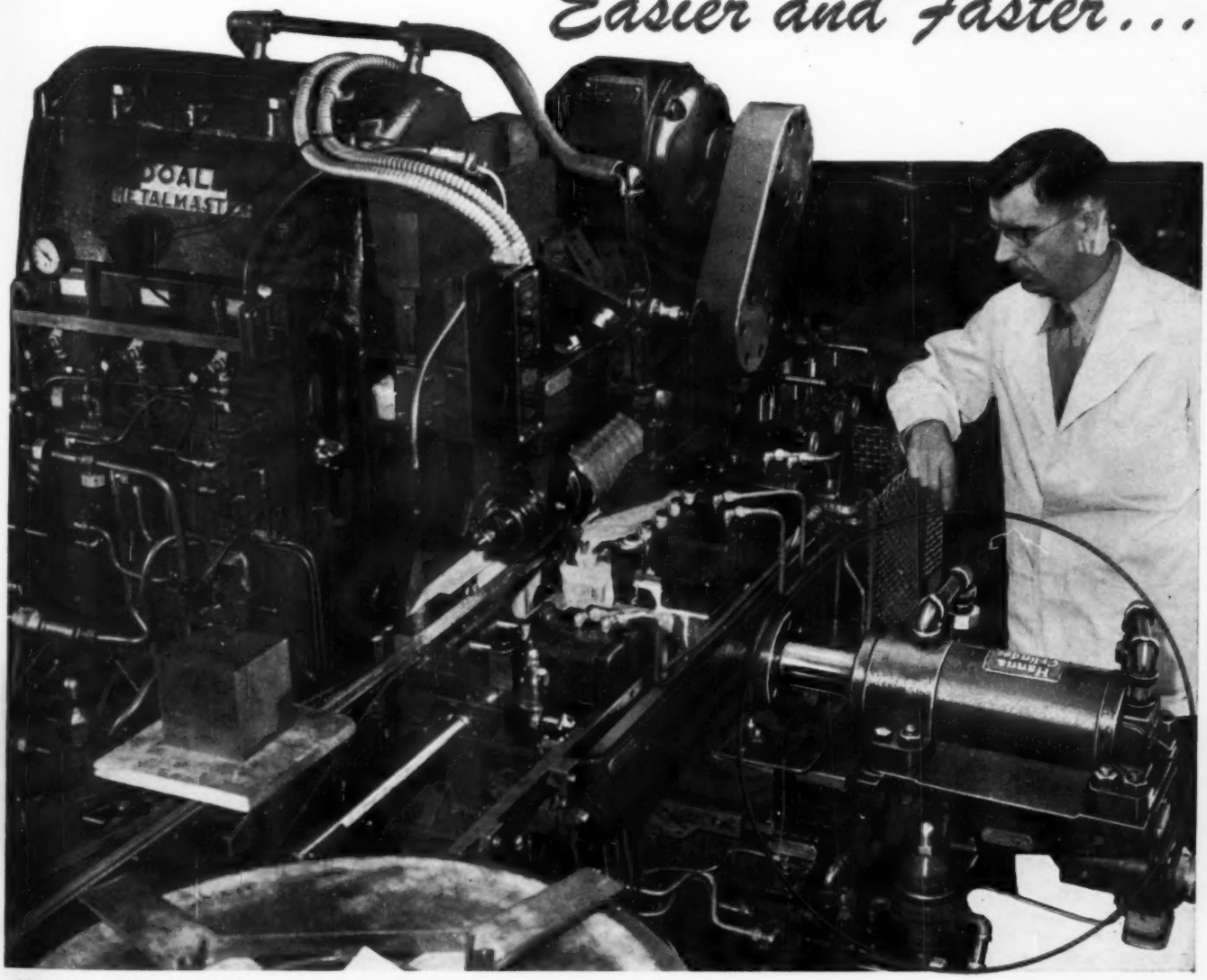
Smooth HANNA HYDRAULIC CYLINDER POWER

... helps this "baby" cut perfect teeth Easier and Faster...



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Hanna Catalog No. 233 gives full details and specifications on High Pressure Cylinders. You should have a copy.

IN THIS unique machine, specially designed by The DoAll Company for automatic tooth-cutting of saw bands, Hanna Hydraulic Cylinder Power plays an important part. The High-Pressure Cylinder feeds steel strips into the milling cutters (where 40 bands may be milled simultaneously) with smooth, dependable precision.

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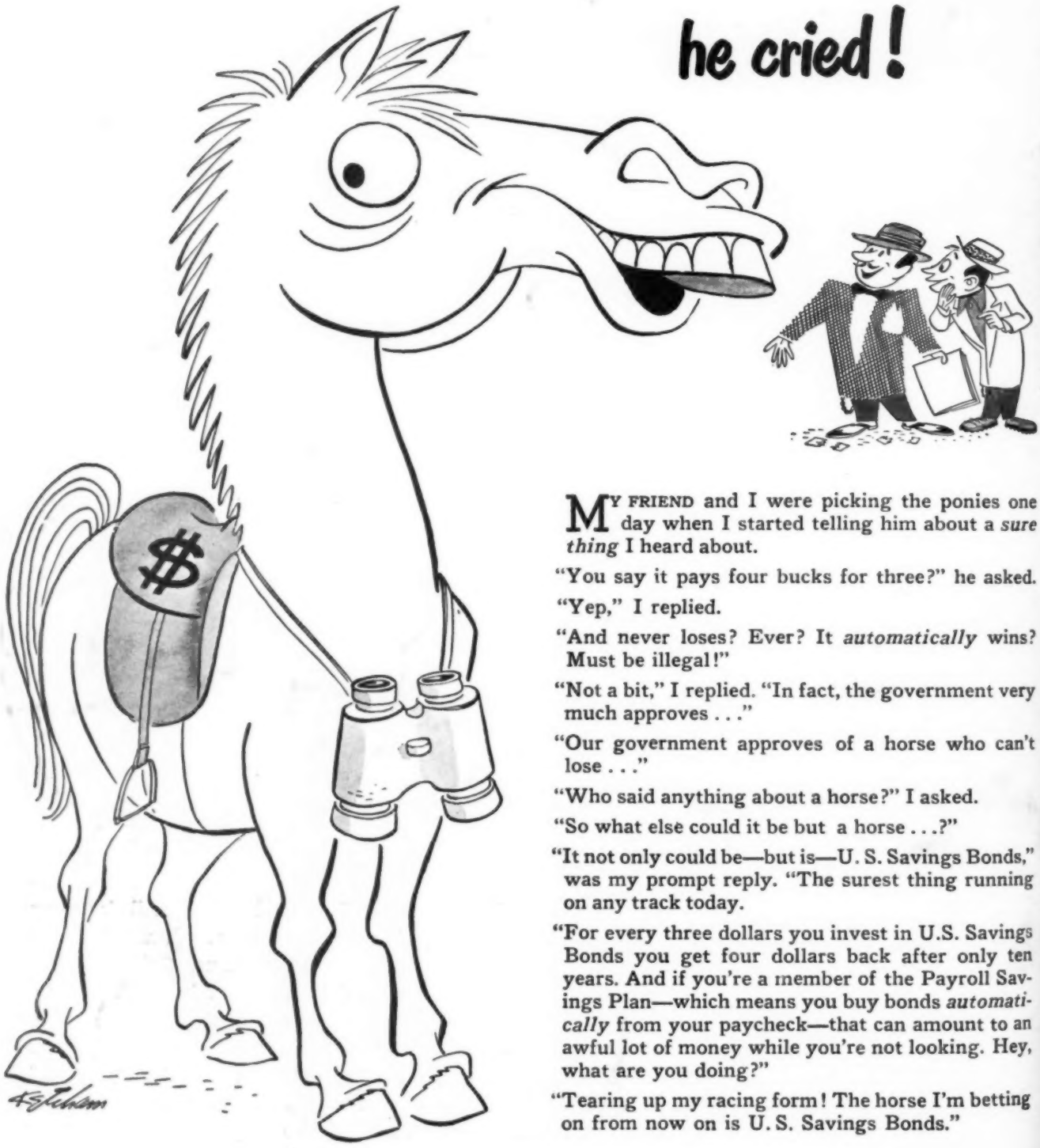
"There's no such animal," he cried!



MY FRIEND and I were picking the ponies one day when I started telling him about a *sure thing* I heard about.

"You say it pays four bucks for three?" he asked.

"Yep," I replied.

"And never loses? Ever? It *automatically* wins? Must be illegal!"

"Not a bit," I replied. "In fact, the government very much approves . . ."

"Our government approves of a horse who can't lose . . ."

"Who said anything about a horse?" I asked.

"So what else could it be but a horse . . .?"

"It not only could be—but is—U. S. Savings Bonds," was my prompt reply. "The surest thing running on any track today.

"For every three dollars you invest in U.S. Savings Bonds you get four dollars back after only ten years. And if you're a member of the Payroll Savings Plan—which means you buy bonds *automatically* from your paycheck—that can amount to an awful lot of money while you're not looking. Hey, what are you doing?"

"Tearing up my racing form! The horse I'm betting on from now on is U. S. Savings Bonds."

Automatic saving is <u>sure</u> saving—U.S. Savings Bonds

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